US010714920B2

(12) United States Patent
West et al.

(10) Patent No.: US 10,714,920 B2
(45) Date of Patent: Jul. 14, 2020

(54) ELECTRONIC TRANSITION CHAMBER

(71) Applicant: **Franklin Fueling Systems, LLC**, Madison, WI (US)

(72) Inventors: **John West**, Ipswich (GB); **Paul Ridge**, Sudbury (GB)

(73) Assignee: **Franklin Fueling Systems**, Madison, WI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 122 days.

(21) Appl. No.: **15/564,729**

(22) PCT Filed: **Jul. 28, 2015**

(86) PCT No.: **PCT/US2015/042450**

§ 371 (c)(1),
(2) Date: **Oct. 5, 2017**

(87) PCT Pub. No.: **WO2016/164064**

PCT Pub. Date: **Oct. 13, 2016**

(65) **Prior Publication Data**

US 2019/0097406 A1 Mar. 28, 2019

Related U.S. Application Data

(60) Provisional application No. 62/143,424, filed on Apr. 6, 2015, provisional application No. 62/143,876, filed
(Continued)

(51) **Int. Cl.**

H02G 3/08	(2006.01)
H02G 15/013	(2006.01)
H02G 9/10	(2006.01)

(52) **U.S. Cl.**
CPC ***H02G 9/10*** (2013.01); ***H02G 15/013*** (2013.01)

(58) **Field of Classification Search**
CPC .. H02G 9/10; H02G 9/00; H02G 9/02; H02G 9/04; H02G 9/06; H02G 15/00;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,396,434 A * 11/1921 Horton H02G 3/14 220/3.8
4,685,581 A 8/1987 Kaneda et al.
(Continued)

FOREIGN PATENT DOCUMENTS

CN 2070045 U 1/1991
CN 1168015 A 12/1997
(Continued)

OTHER PUBLICATIONS

International Search Report for PCT/US2015/042450 dated Jan. 13, 2016, 4 pages.

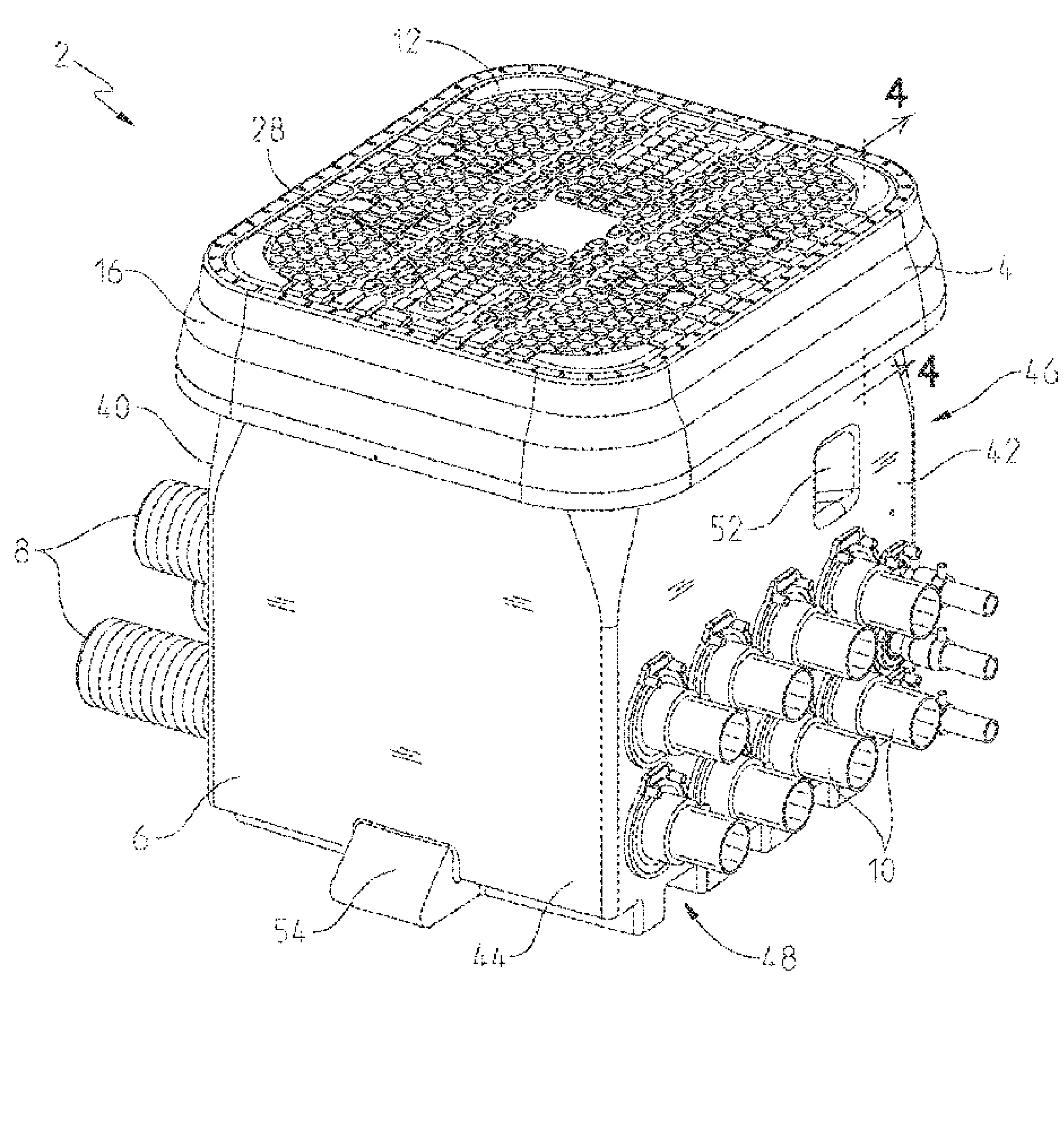
(Continued)

Primary Examiner — Angel R Estrada
(74) *Attorney, Agent, or Firm* — Faegre Drinker Biddle & Reath LLP

(57) **ABSTRACT**

A chamber for a fueling system includes a housing configured to organize electrical lines based on electrical characteristics. The electrical lines are routed through the electrical transition chamber and extend between a plurality of inlets and a plurality of outlets of the chamber. Additionally, the chamber may include at least one entry seal for carrying the electrical lines into and/or out of the electrical transition chamber. The entry seal includes an electrofusion winding and a compression fitting.

30 Claims, 29 Drawing Sheets



Related U.S. Application Data

on Apr. 7, 2015, provisional application No. 62/192,851, filed on Jul. 15, 2015.

(58) **Field of Classification Search**

CPC H02G 15/013; H02G 15/06; H02G 15/08; H02G 3/08; H02G 3/081; H02G 3/083; H05K 5/00; H05K 5/02; H05K 5/0217; H05K 5/0247; H01R 13/46

USPC 174/50, 520, 59, 549, 559, 53, 60, 68.1, 174/50.5; 220/3.2–3.9, 4.02; 361/600, 361/601, 641

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,190,408	A *	3/1993	Ozeki	H02G 9/10 174/37	
5,257,487	A *	11/1993	Bantz	H02G 3/283 174/486	
D364,143	S	11/1995	Weingartner		
5,468,908	A *	11/1995	Arthur	H02G 3/185 174/482	
5,528,941	A	6/1996	Ogawa		
5,796,037	A *	8/1998	Young	H02G 3/185 174/486	
5,831,212	A *	11/1998	Whitehead	H02G 3/121 174/50	
6,610,927	B2	8/2003	Dinh et al.		
6,831,222	B2	12/2004	Pastuch		
7,075,005	B1 *	7/2006	Drane	H02G 3/185 174/50	
7,762,415	B2	7/2010	Matsui		
7,968,806	B2	6/2011	Shelton et al.		
8,035,029	B2	10/2011	Mullen		
8,248,804	B2 *	8/2012	Han	H02S 40/345 136/244	
8,436,259	B2	5/2013	Green et al.		
8,546,984	B2	10/2013	Heilman et al.		
2013/0050956	A1	2/2013	Wang et al.		
2014/0374133	A1	12/2014	Rost et al.		
2015/0007899	A1	1/2015	Ekstam		

FOREIGN PATENT DOCUMENTS

CN	204205483 U	3/2015
DE	2539555	3/1977
EP	1749742	2/2007
FR	2663058	12/1991
GB	2464118	4/2010
KR	10-1203678	11/2012

OTHER PUBLICATIONS

Written Opinion of the International Searching Authority for PCT/US2015/042450 dated Jan. 13, 2016, 5 pages.

English Translation of Chinese Search Report for Application No. 2015800795834, received Jul. 16, 2019, 2 pages.

* cited by examiner

Fig. 1

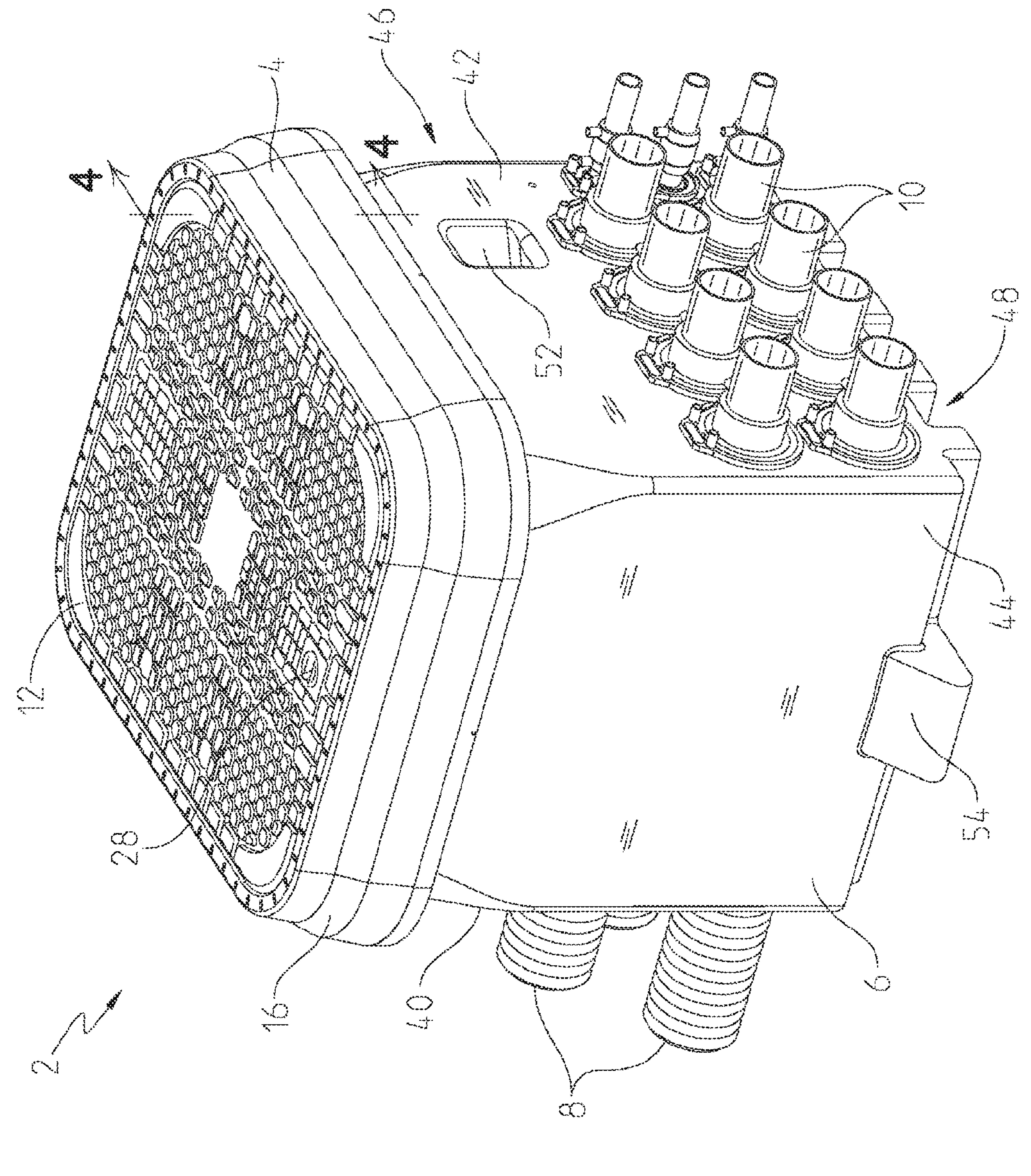
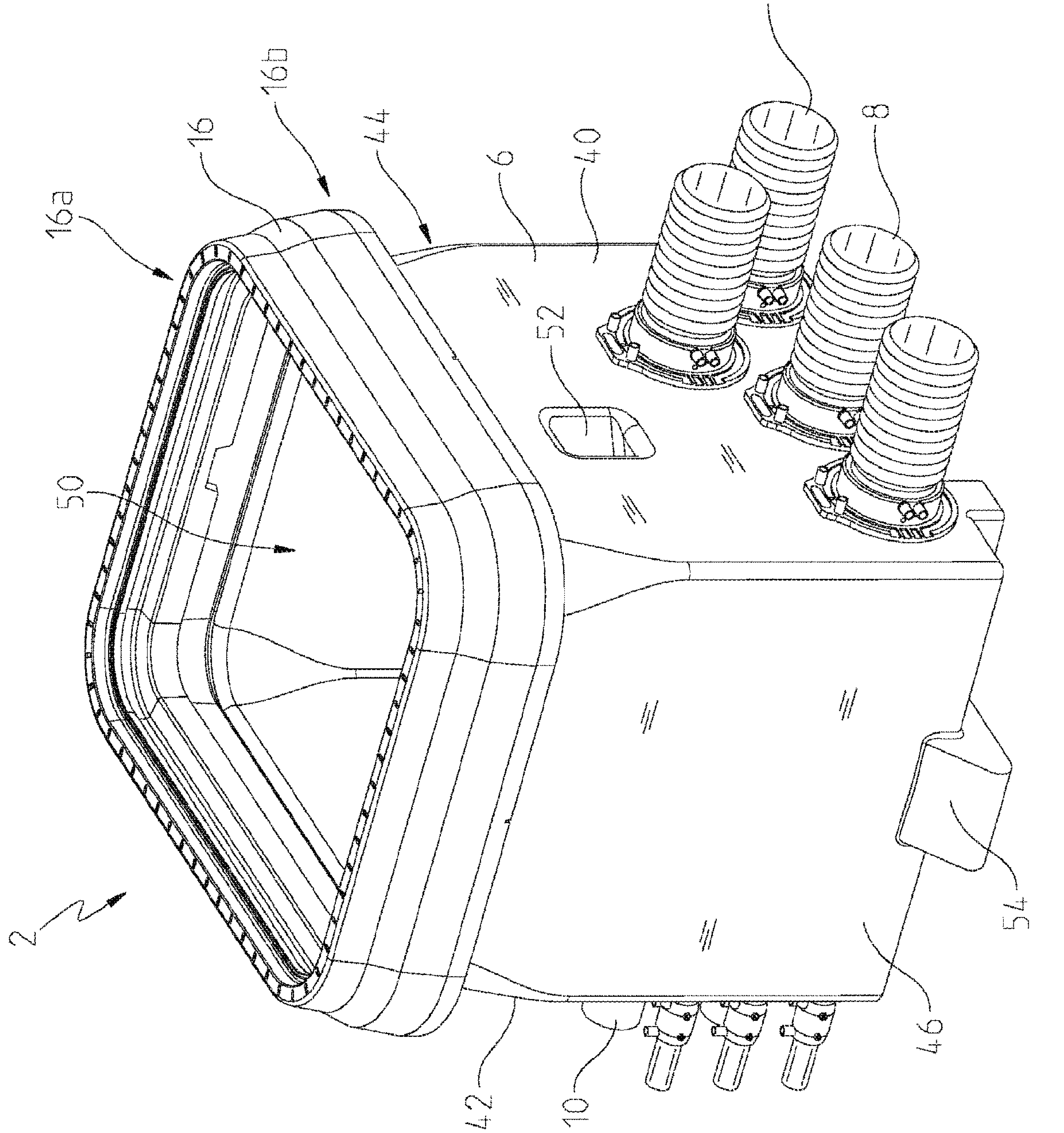


Fig. 2



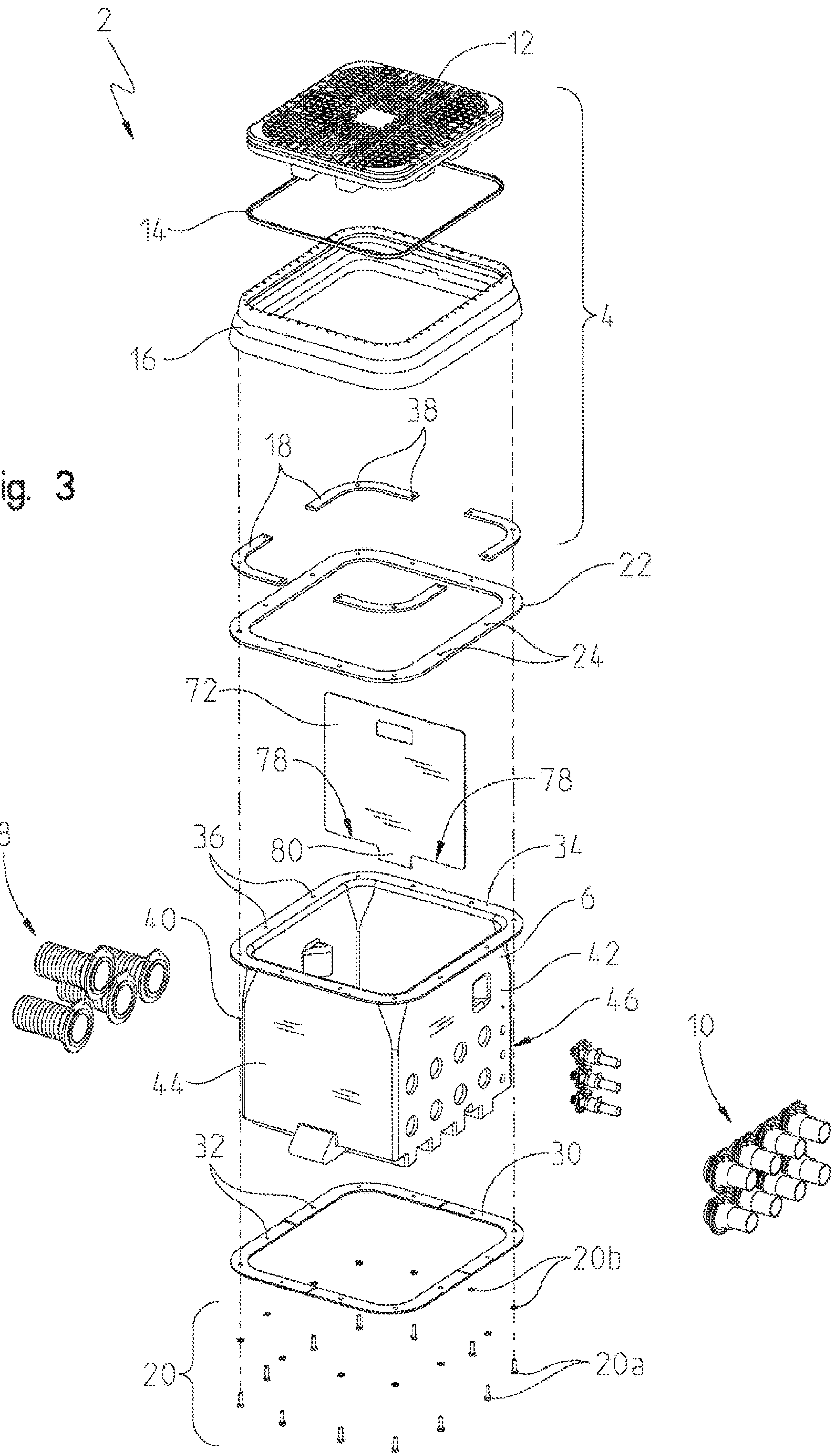

2
12
14
4
16
38
18
22
24
72
78
78
8
36
80
34
6
40
42
46
10
44
32
30
20b
20
20a

Fig. 3

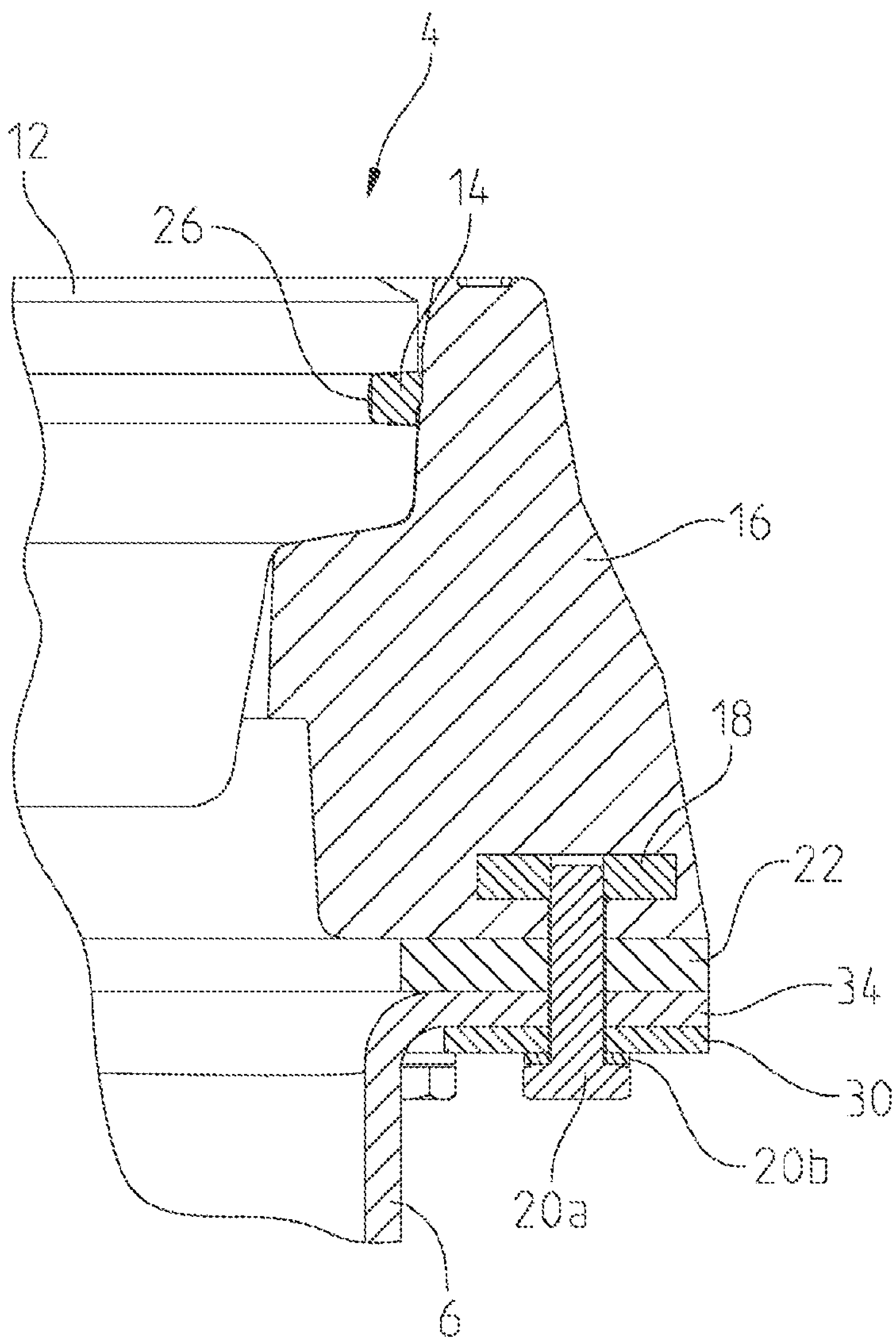


Fig. 4

Fig. 5

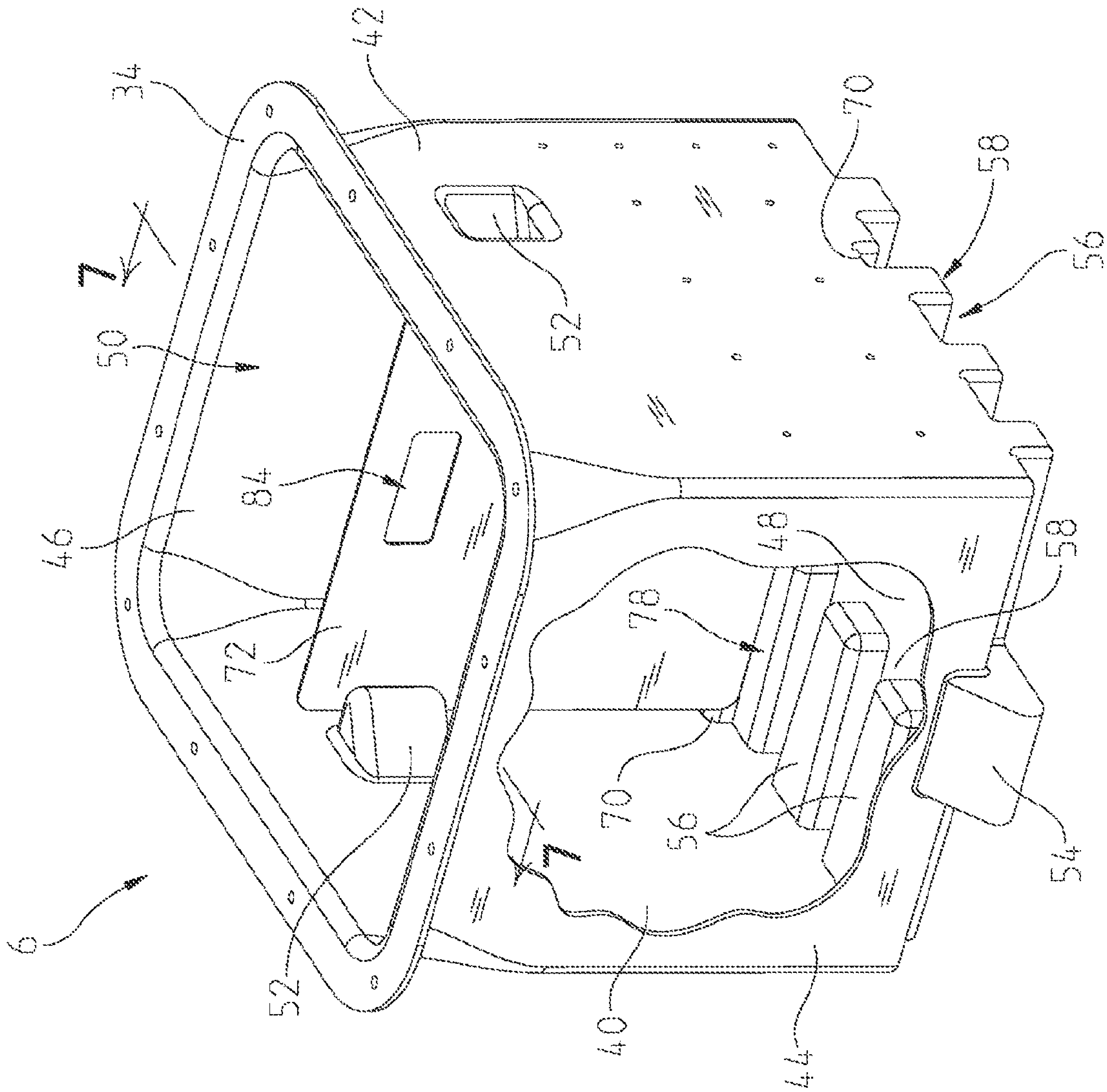
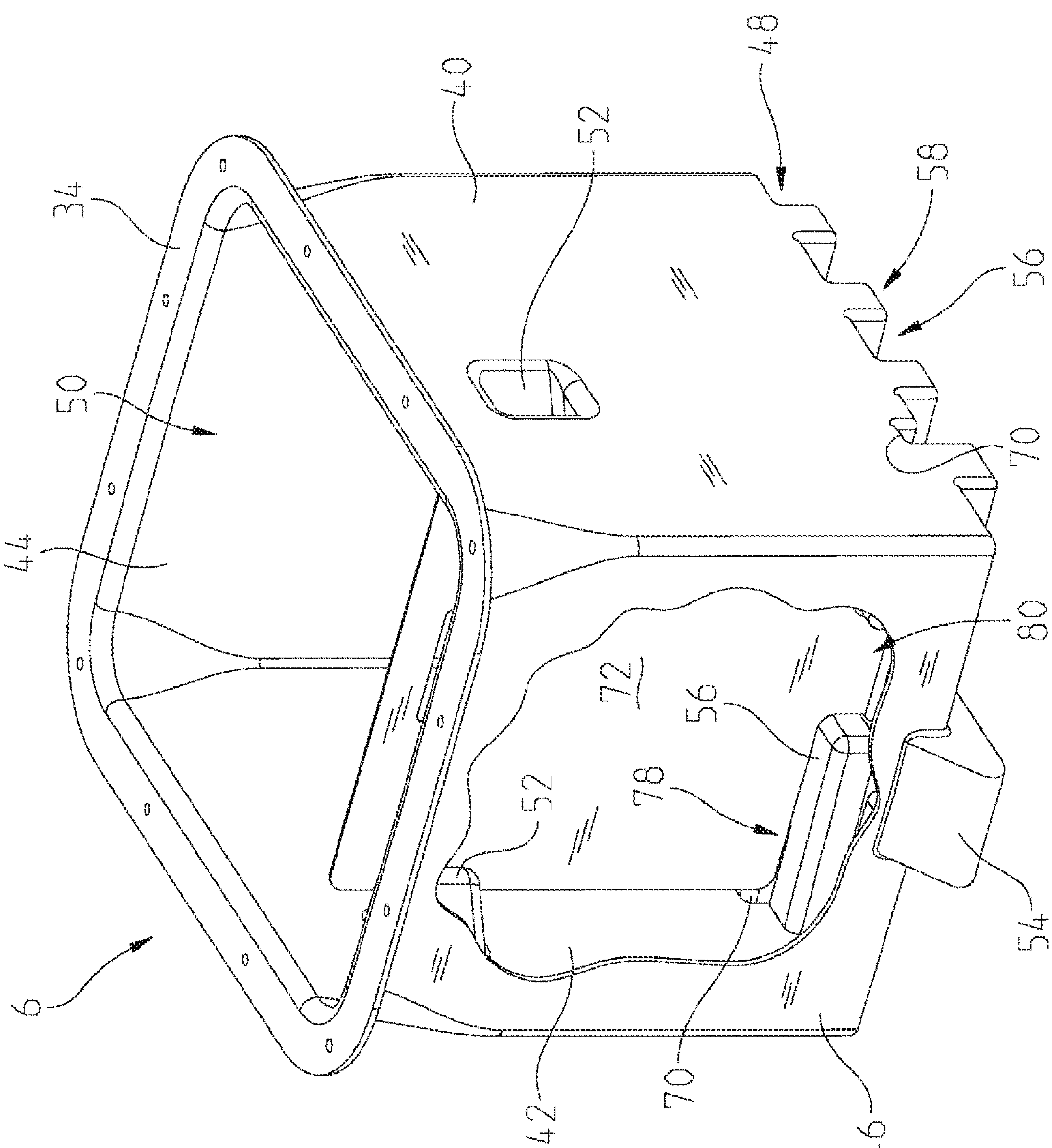


Fig. 6



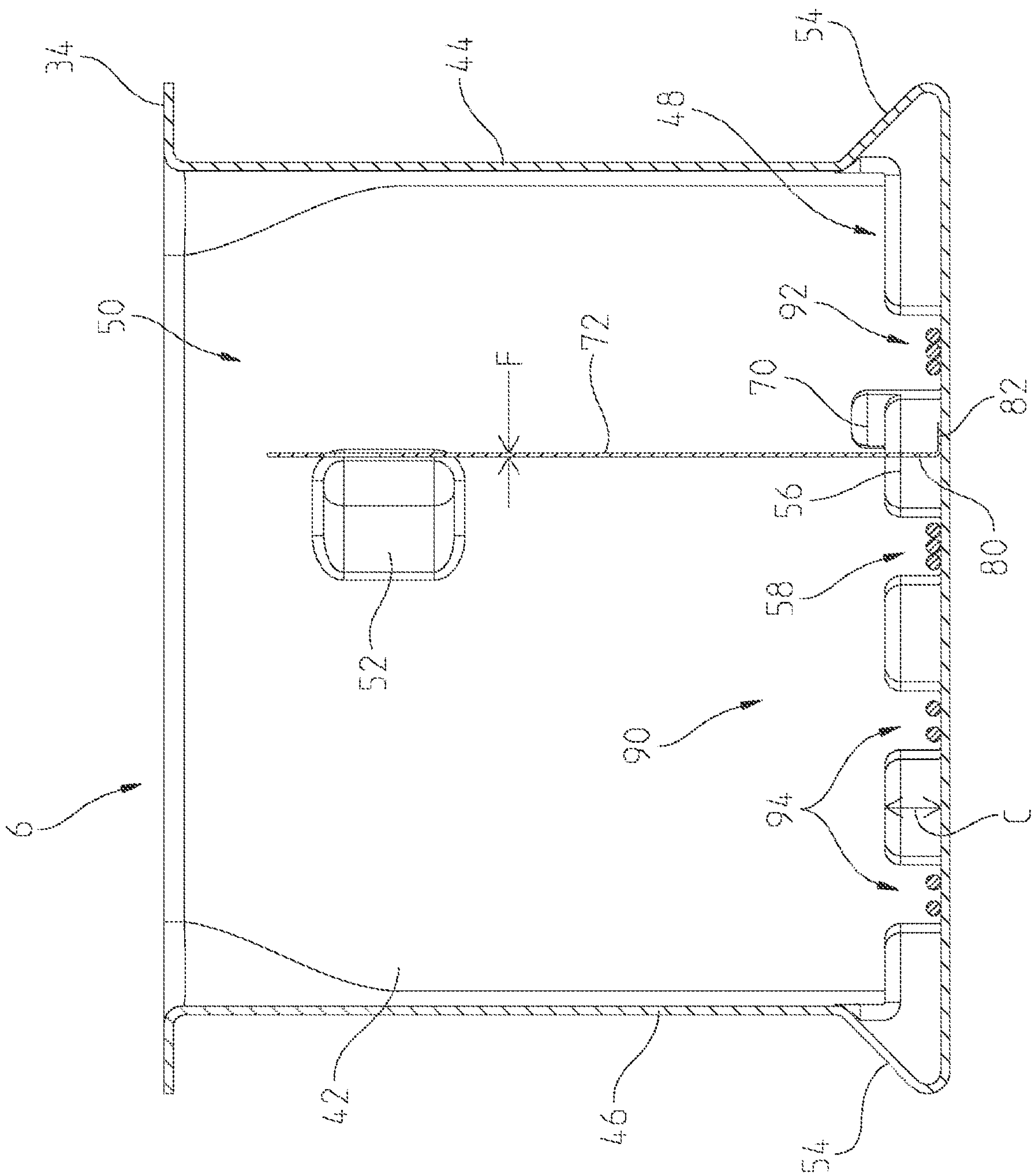


Fig. 7

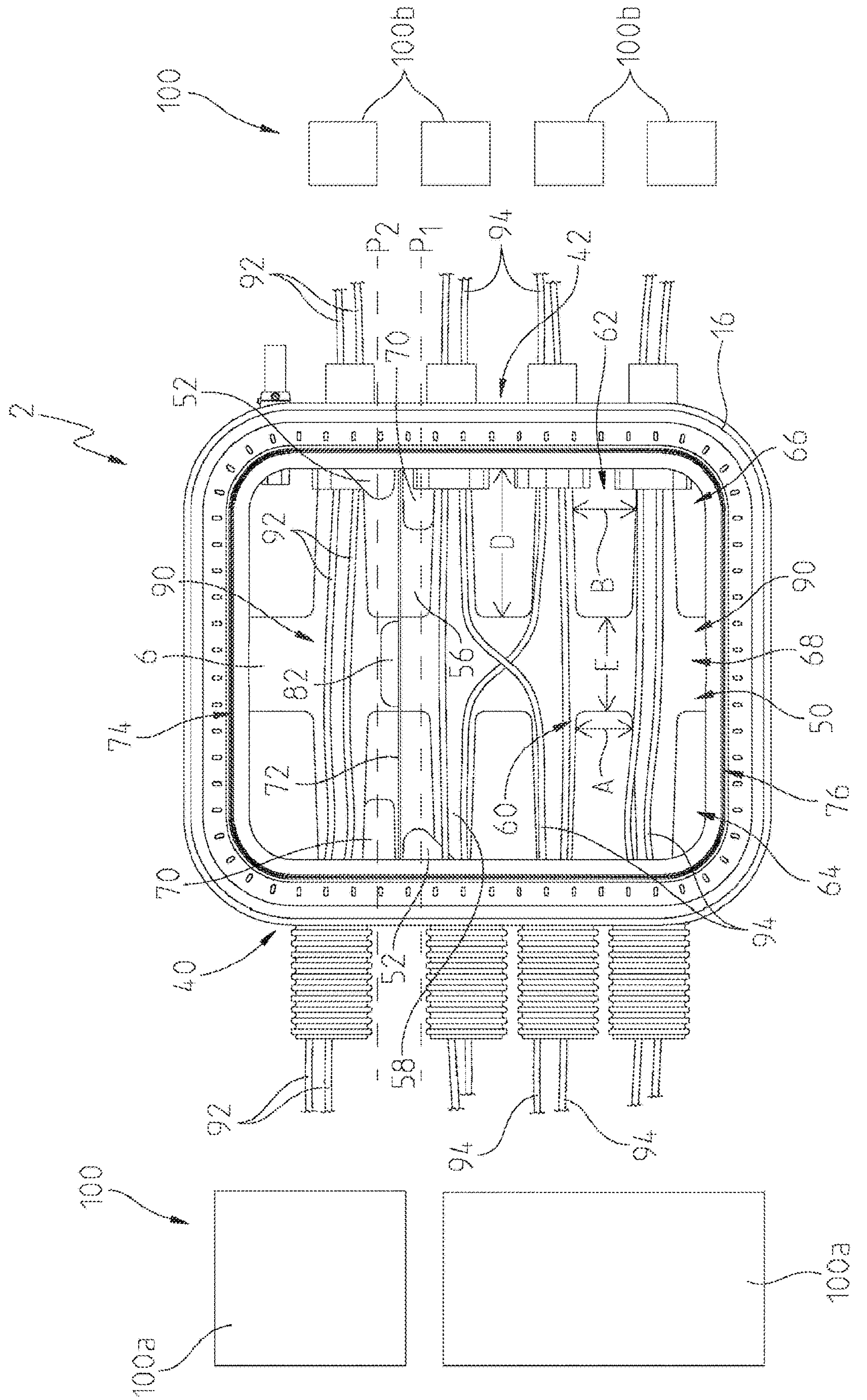

100
100b
100b
2
92
P2
P1
94
42
70
52
62
16
66
92
90
D
B
90
6
82
56
E
68
74
50
72
60
A
76
70
64
94
40
52
58
92
94
94
100
100a
100a

Fig. 8

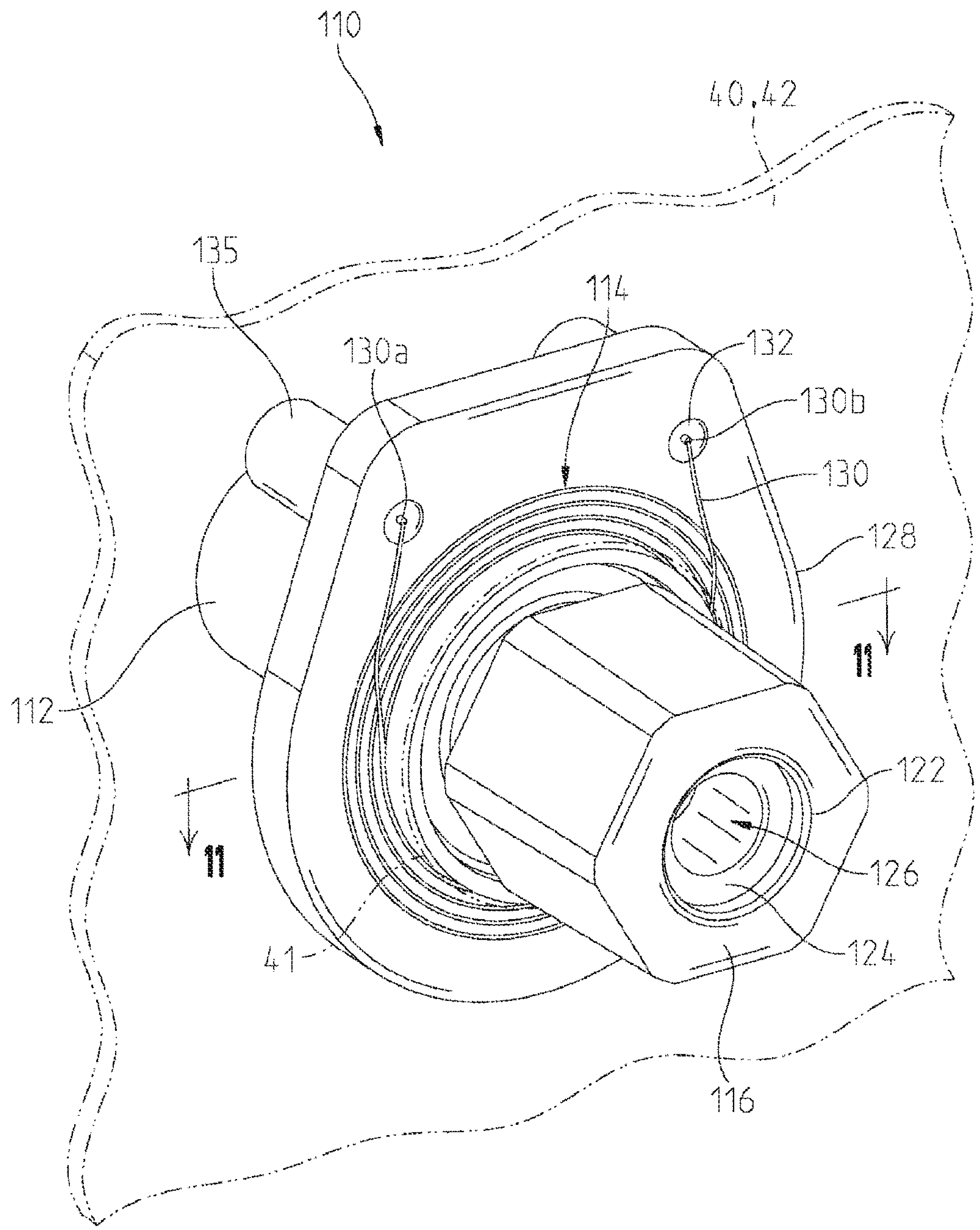

110
40,42
135
114
130a
132
130b
130
128
11
112
122
11
126
41
124
116

Fig. 9

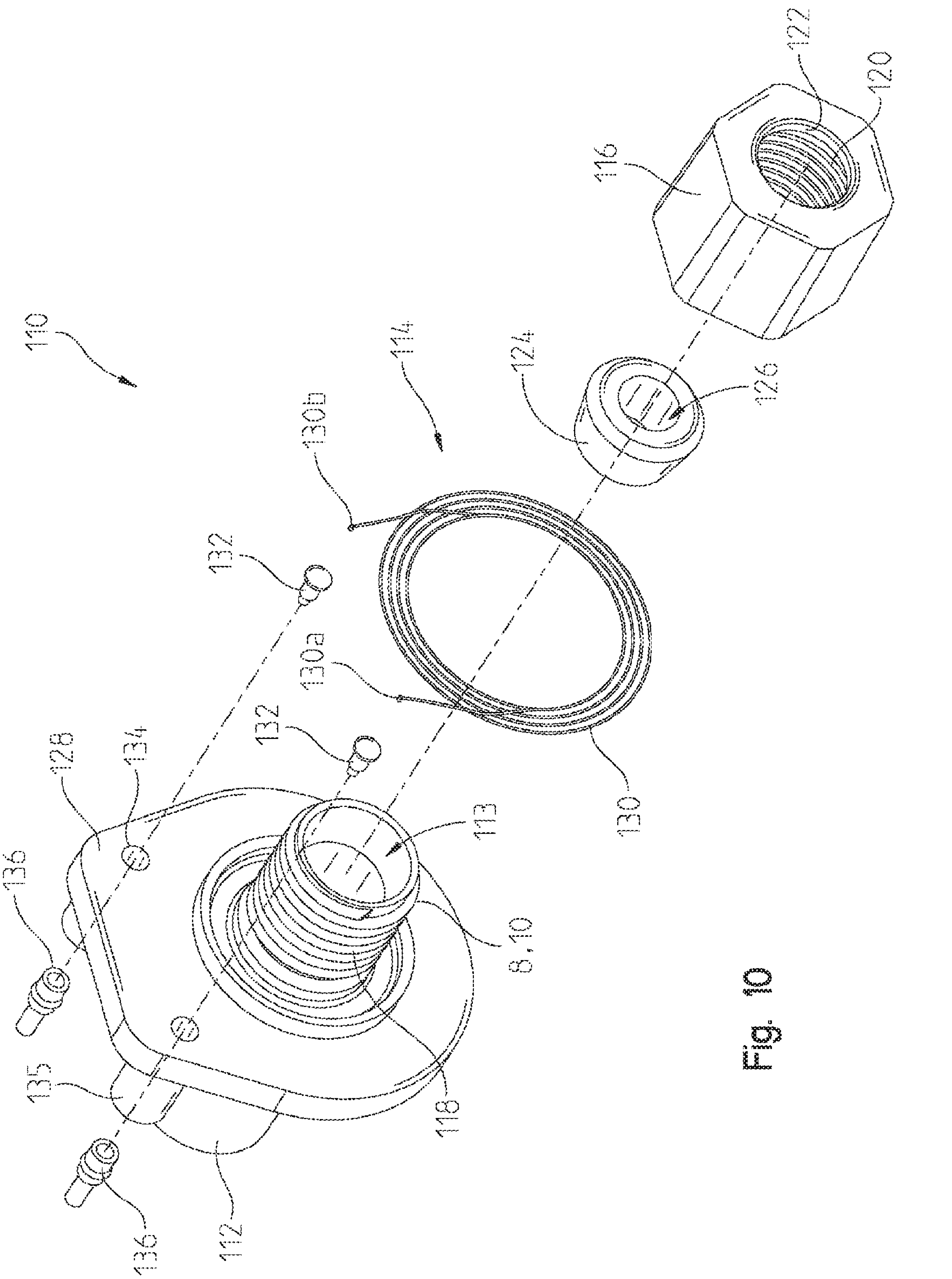
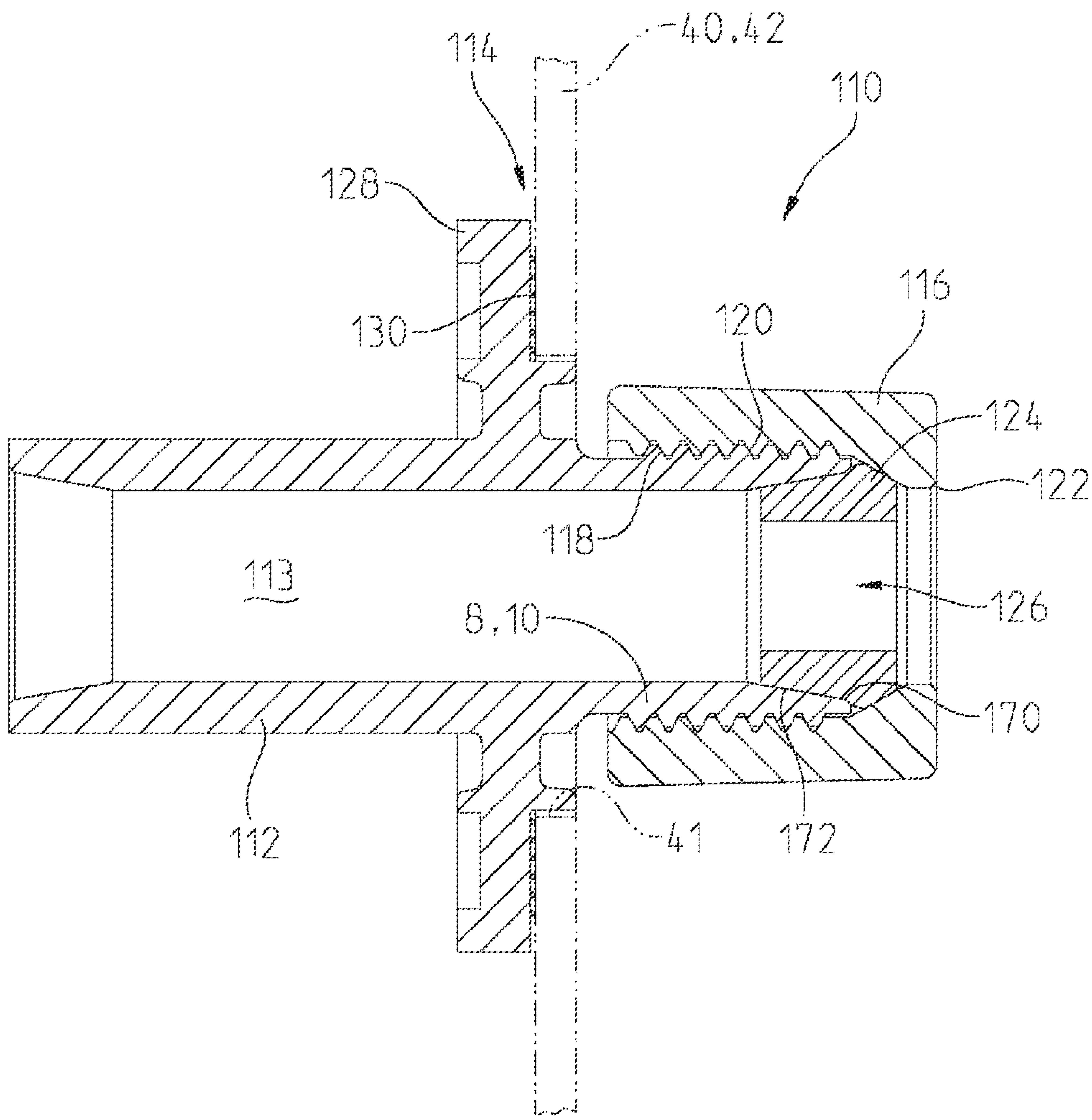

110
114
116
120
122
124
126
130b
132
130a
130
132
134
128
136
113
8,10
118
135
112
136

Fig. 10



114
40,42
110
128
130
120
116
124
122
118
113
8,10
126
170
112
41
172

Fig. 11

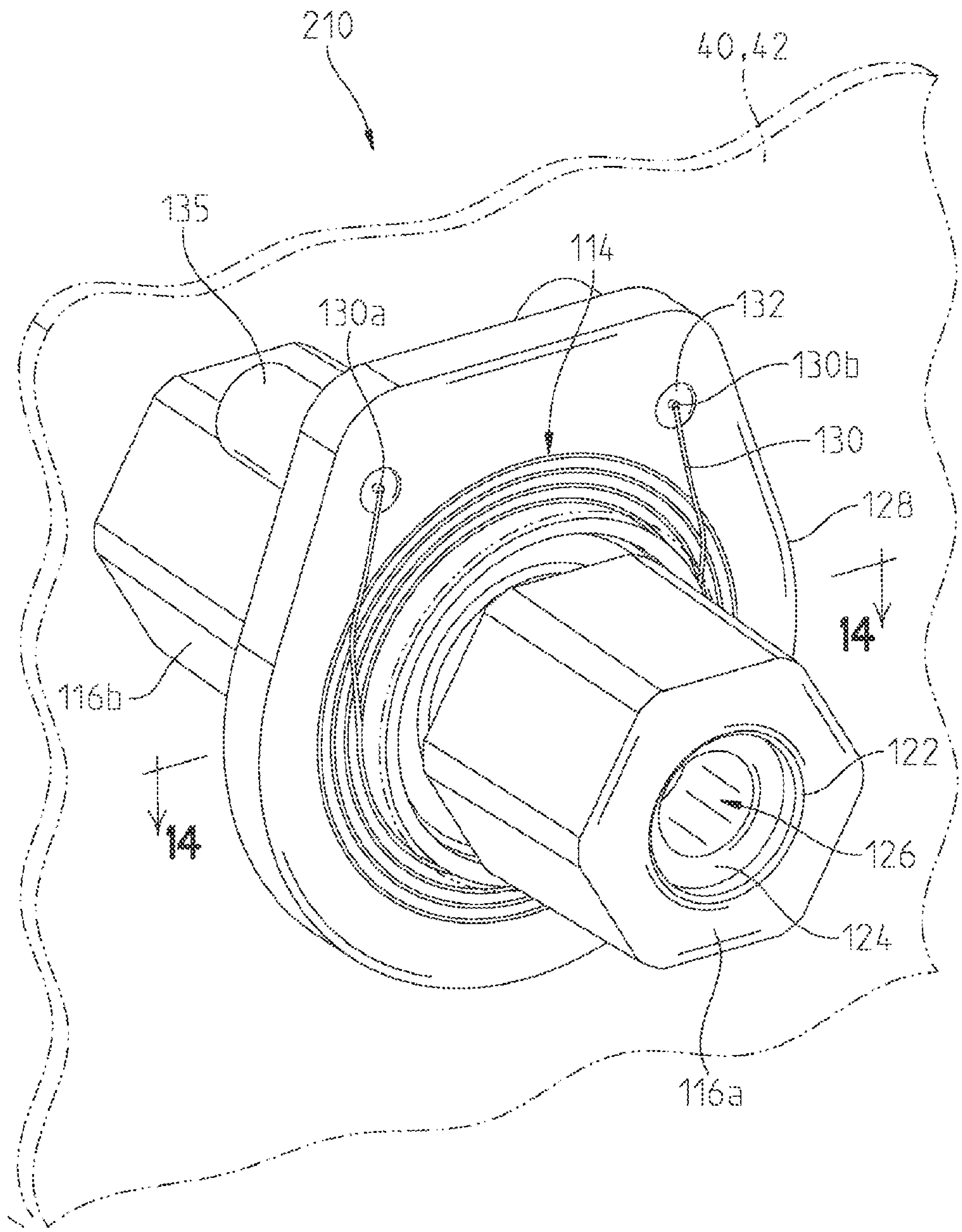

210
40,42
135
114
130a
132
130b
130
128
14
116b
14
122
126
124
116a

Fig. 12

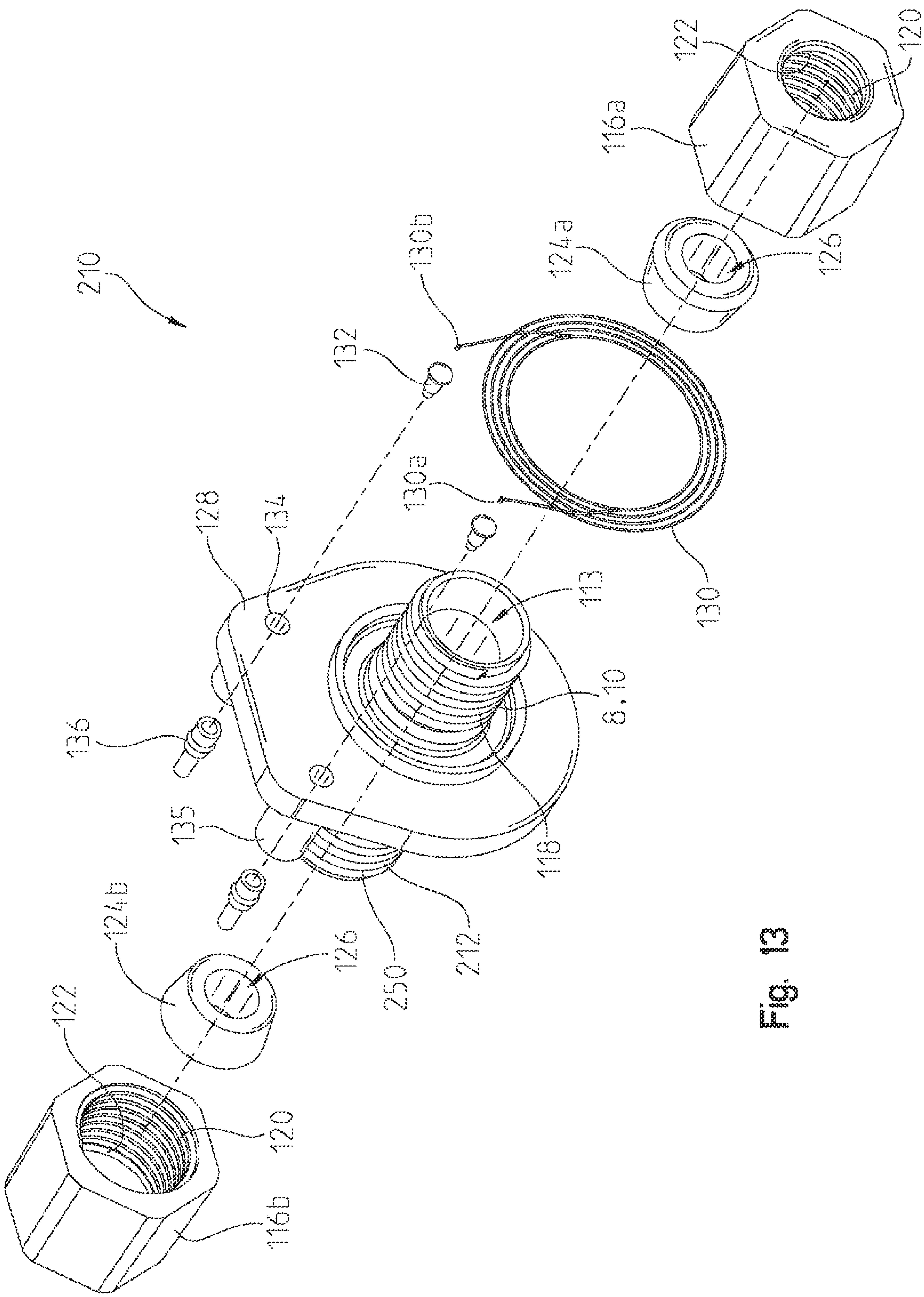
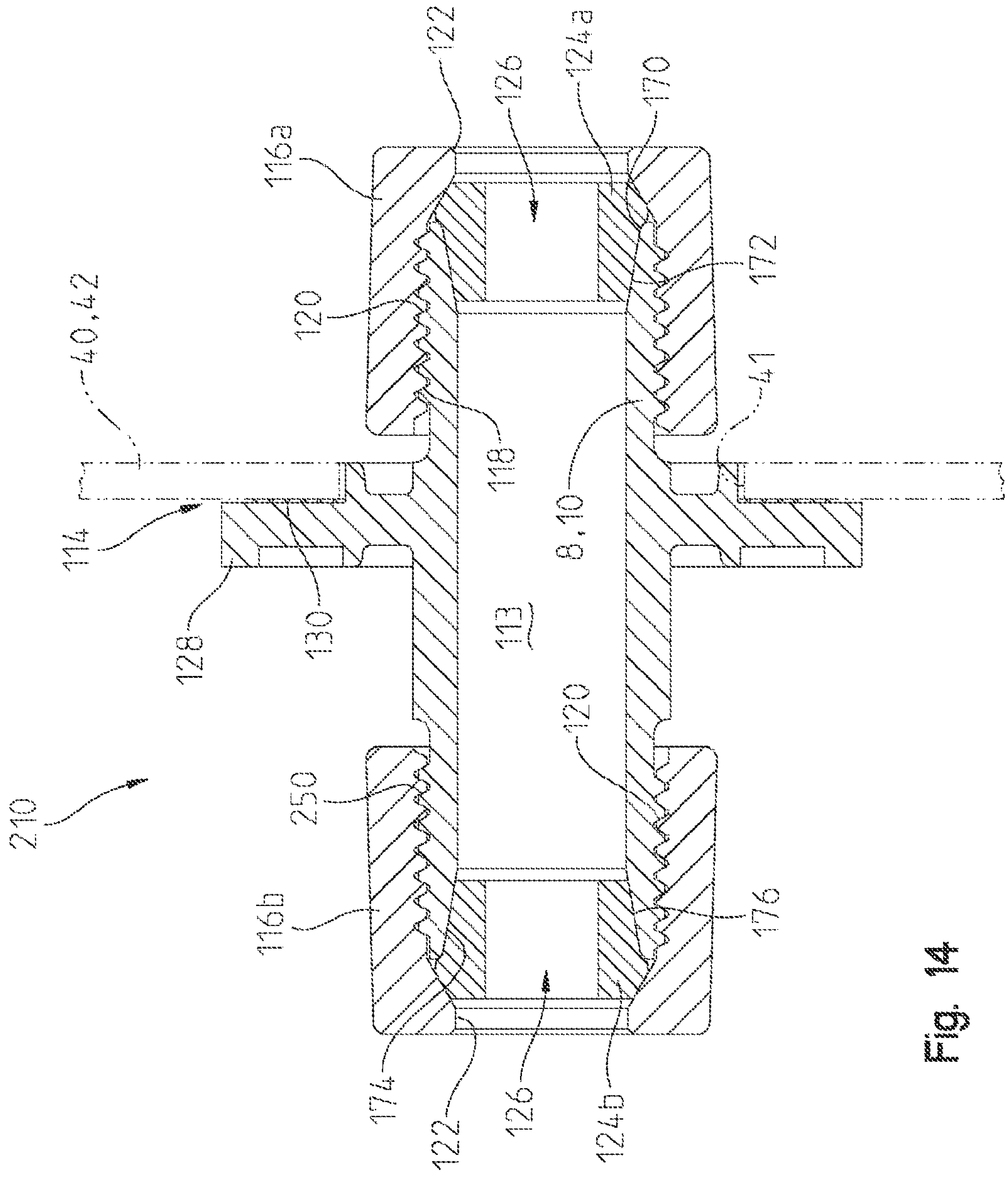

210
122
120
116a
124a
126
130b
132
130a
130
128
134
113
8, 10
136
135
118
212
250
124b
126
122
120
116b

Fig. 13



122
126
124a
170
116a
172
120
40,42
41
118
8,10
114
130
128
113
120
250
210
116b
176
174
122
126
124b

Fig. 14

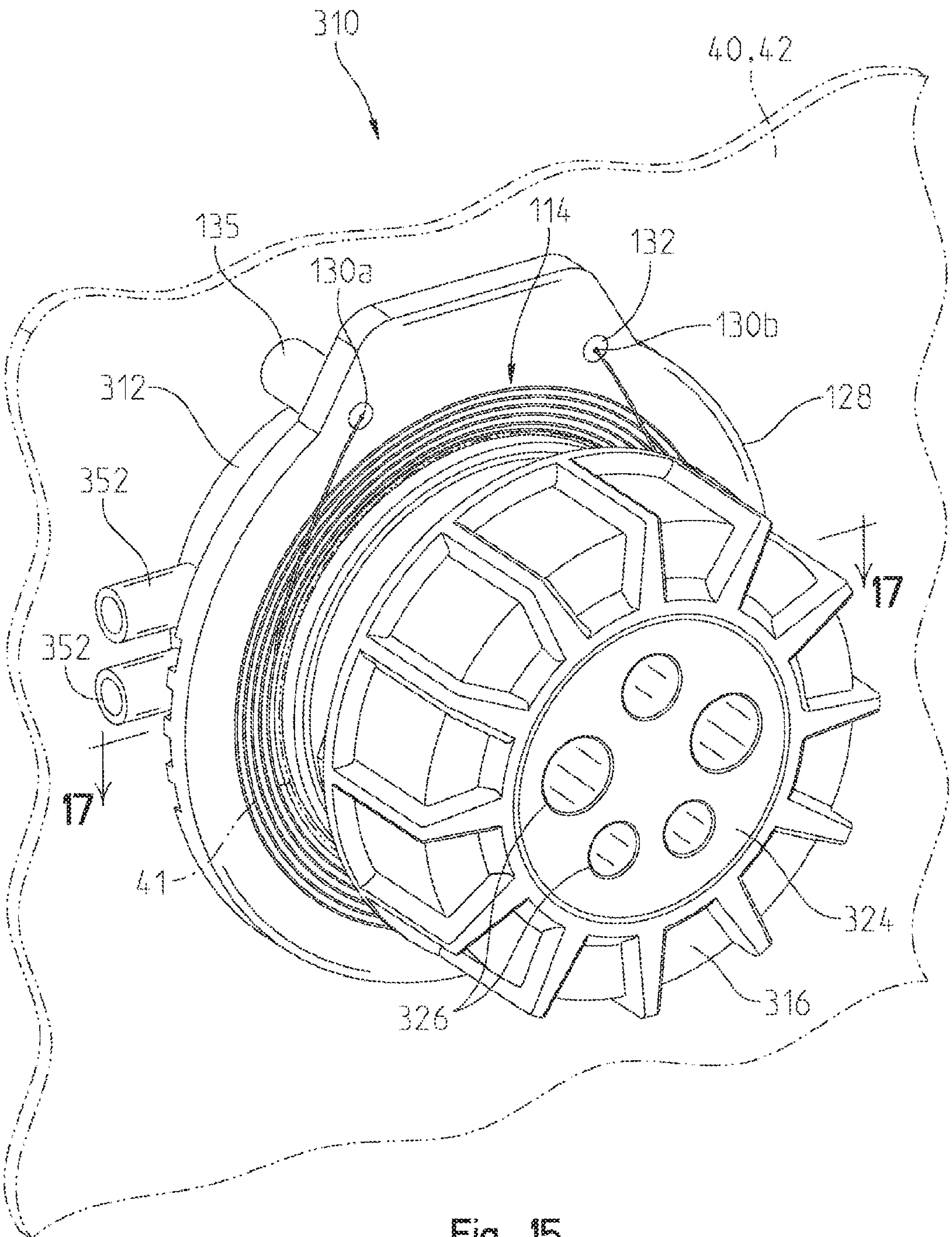

310
40,42
135
114
132
130a
130b
312
128
352
17
352
17
41
324
326
316

Fig. 15

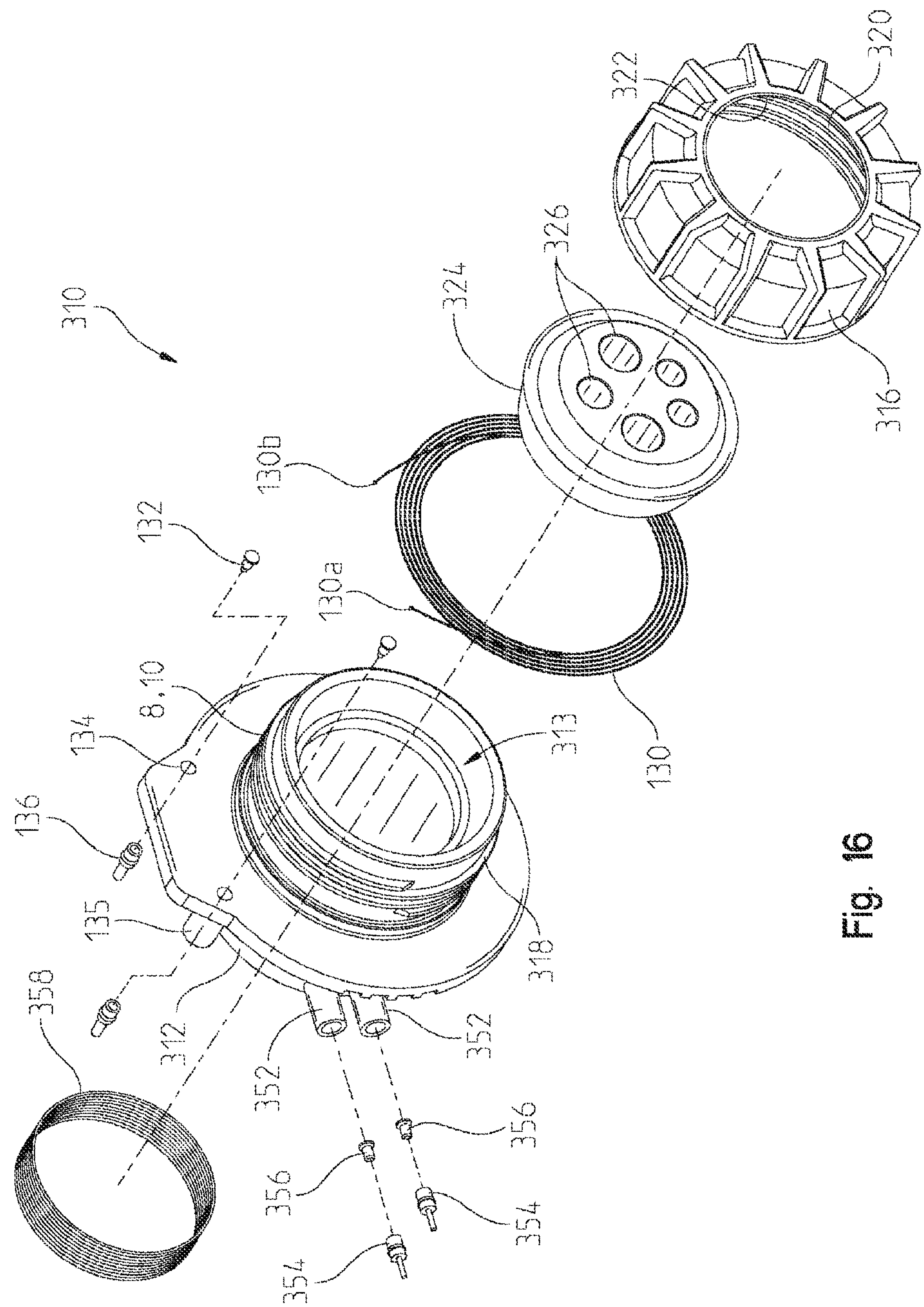

310
322
320
326
324
316
130b
132
130a
8,10
134
313
130
136
135
318
358
312
352
352
356
356
354
354

Fig. 16

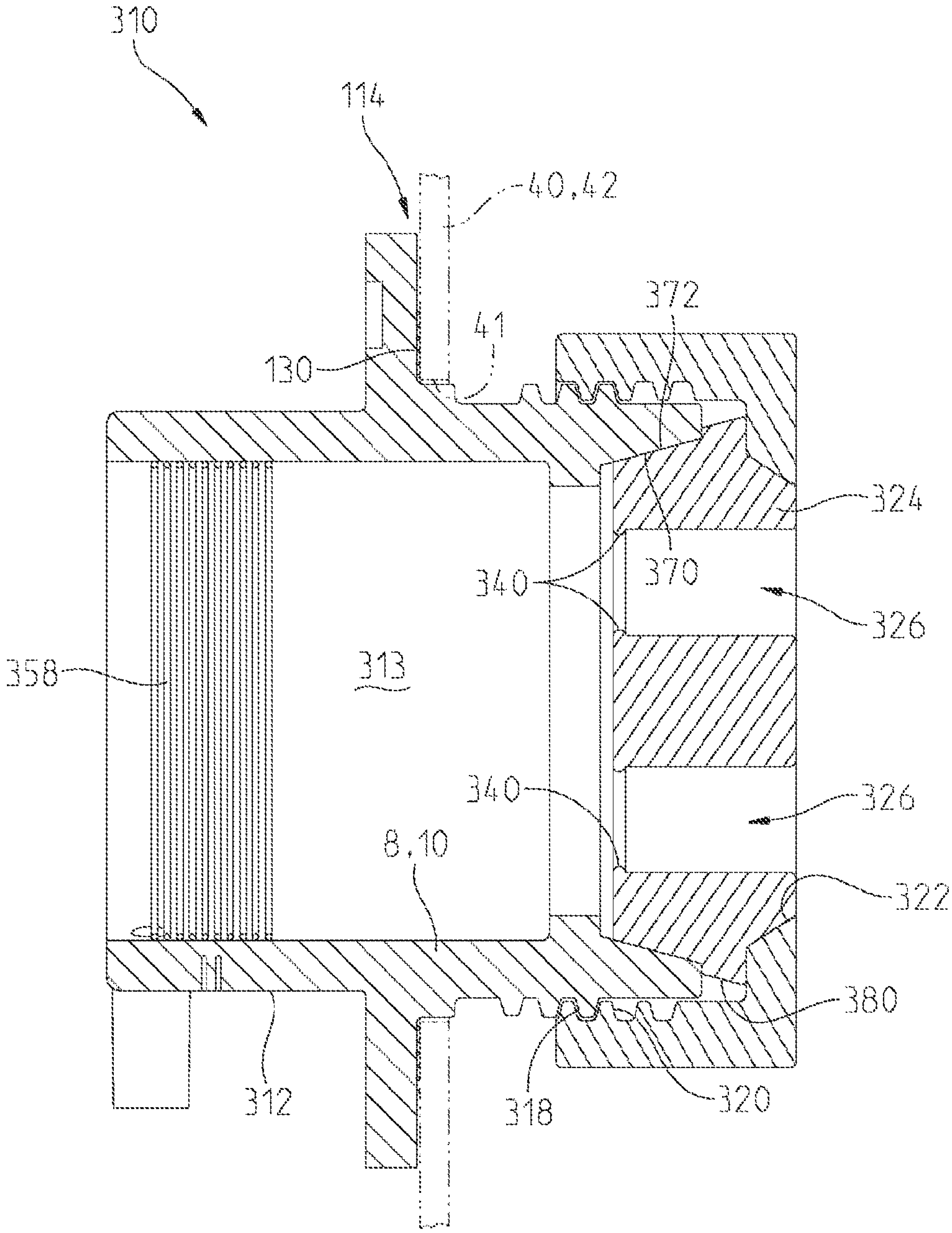

310
114
40,42
372
41
130
324
370
340
326
358
313
340
326
8,10
322
380
312
318
320

Fig. 17

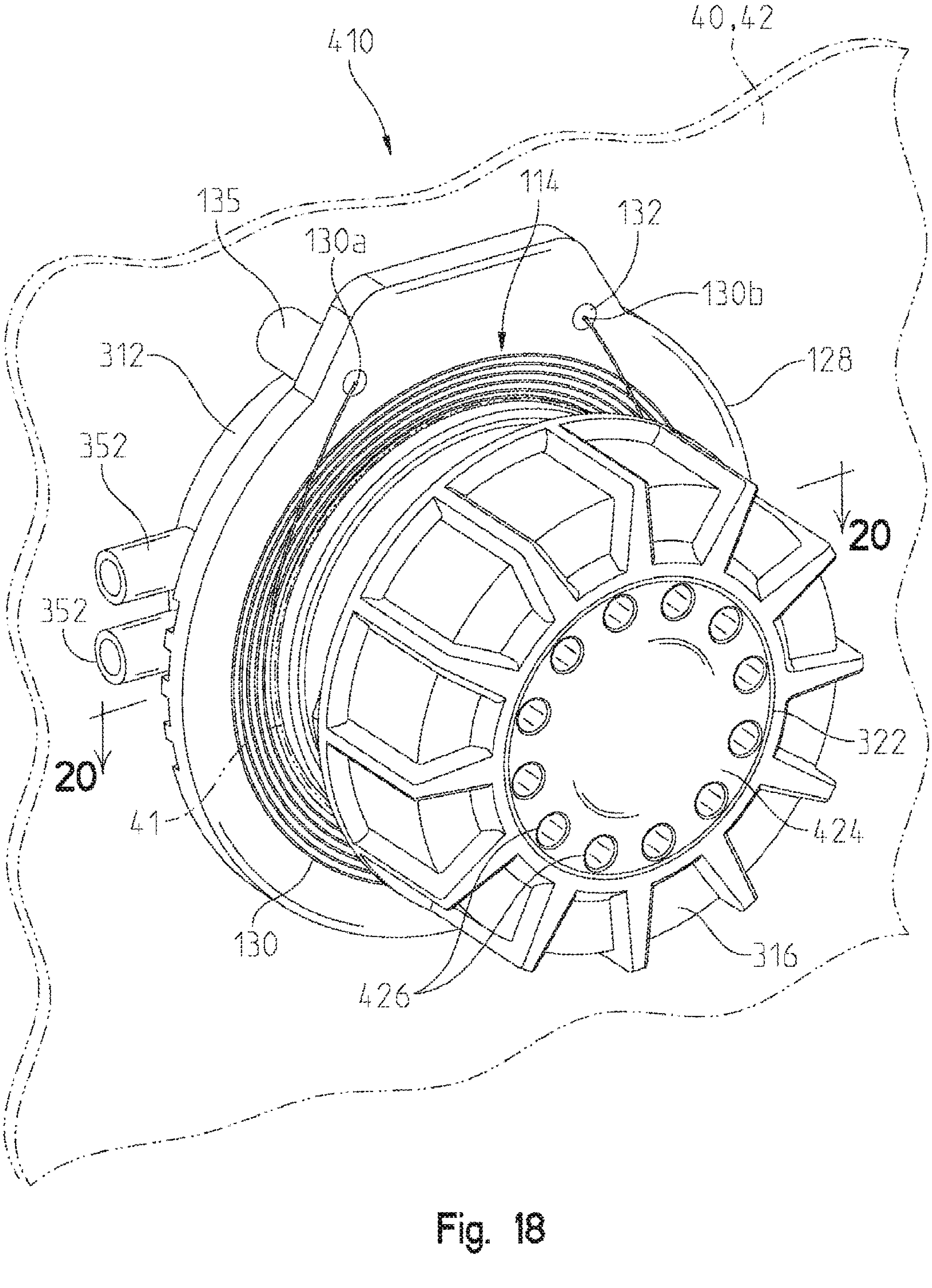

410
40,42
135
130a
114
132
130b
312
128
352
352
20
20
322
41
424
130
316
426

Fig. 18

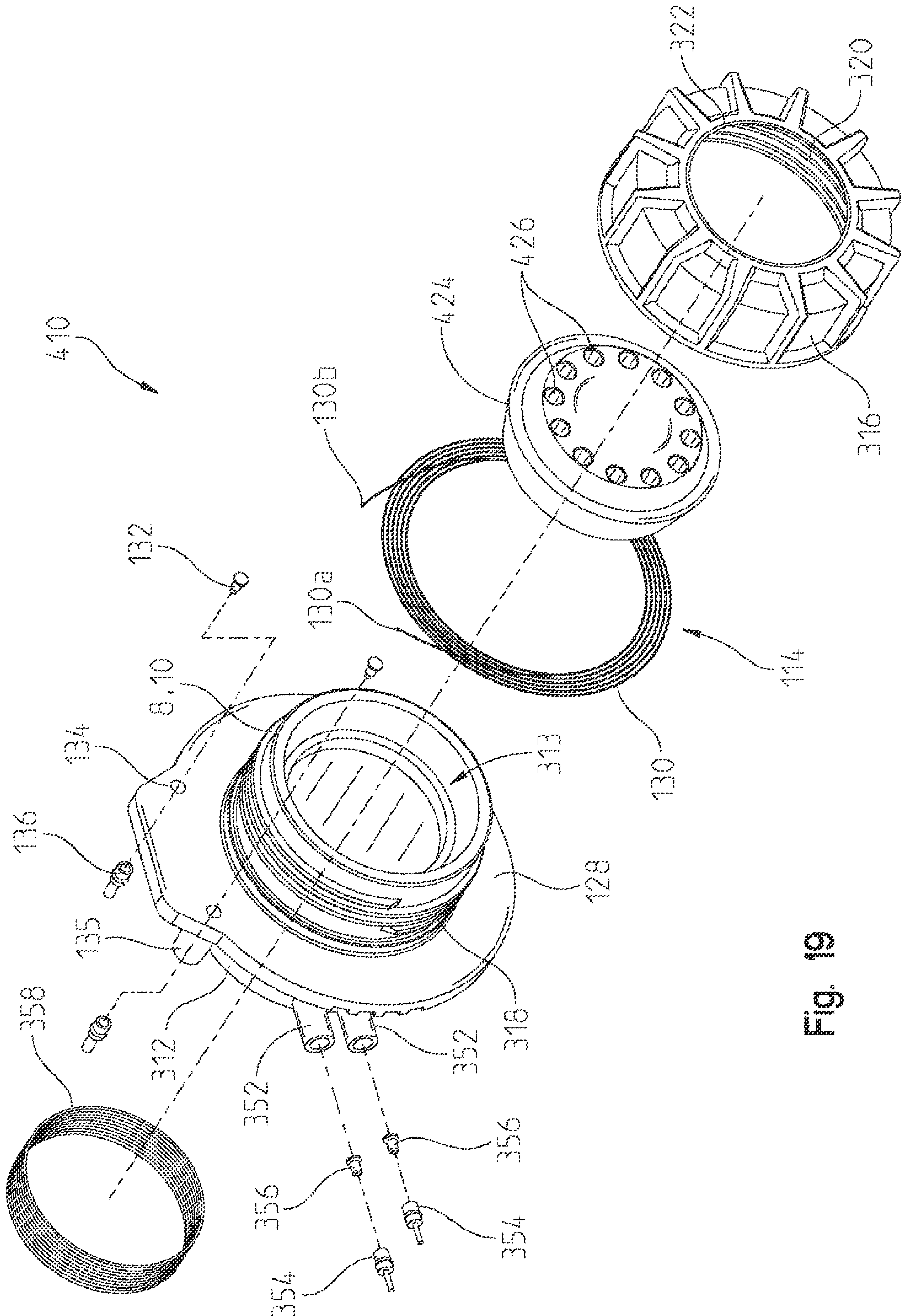

410
322
320
426
424
130b
316
132
130a
114
8,10
134
313
136
130
128
135
358
312
318
352
352
356
356
354
354

Fig. 19

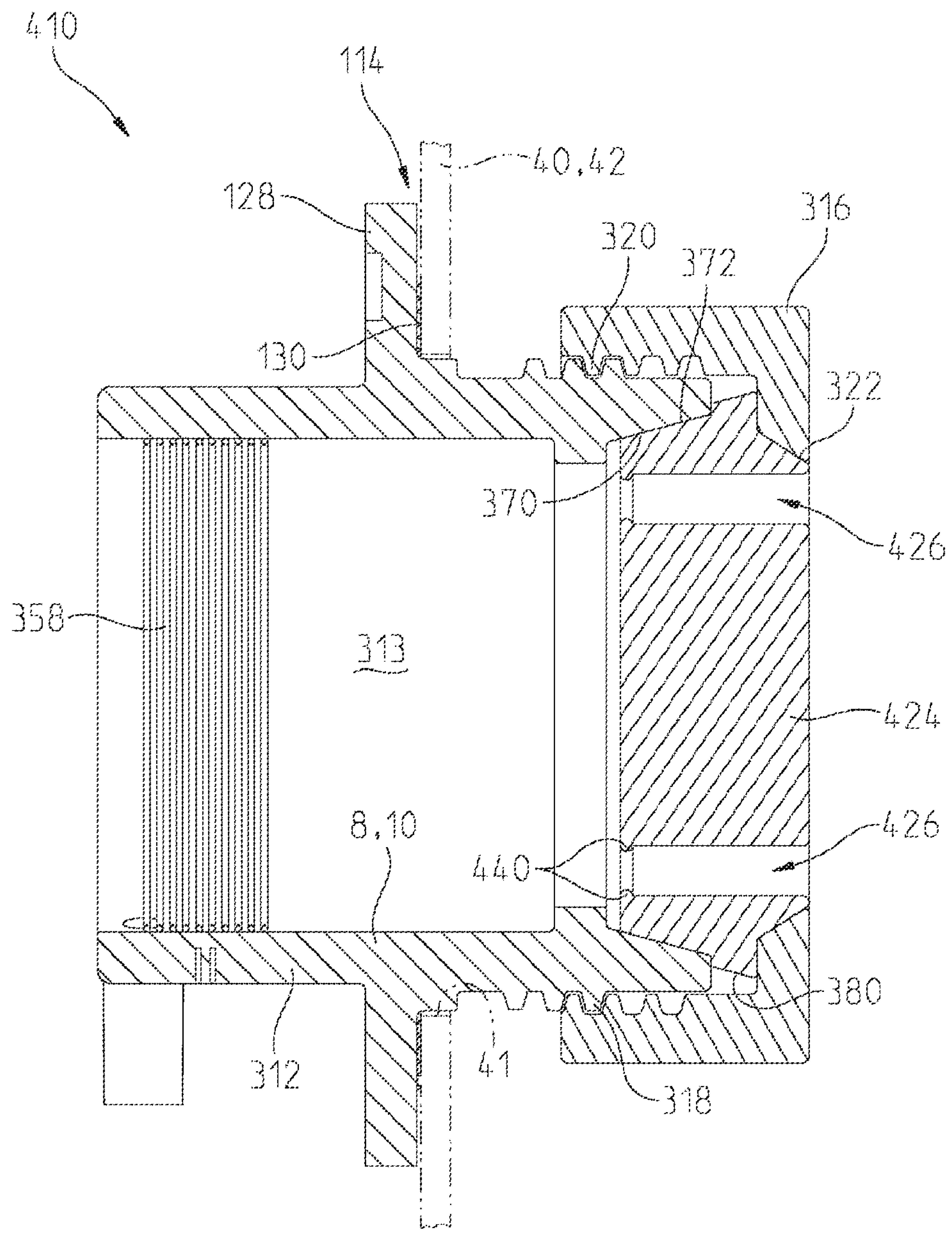
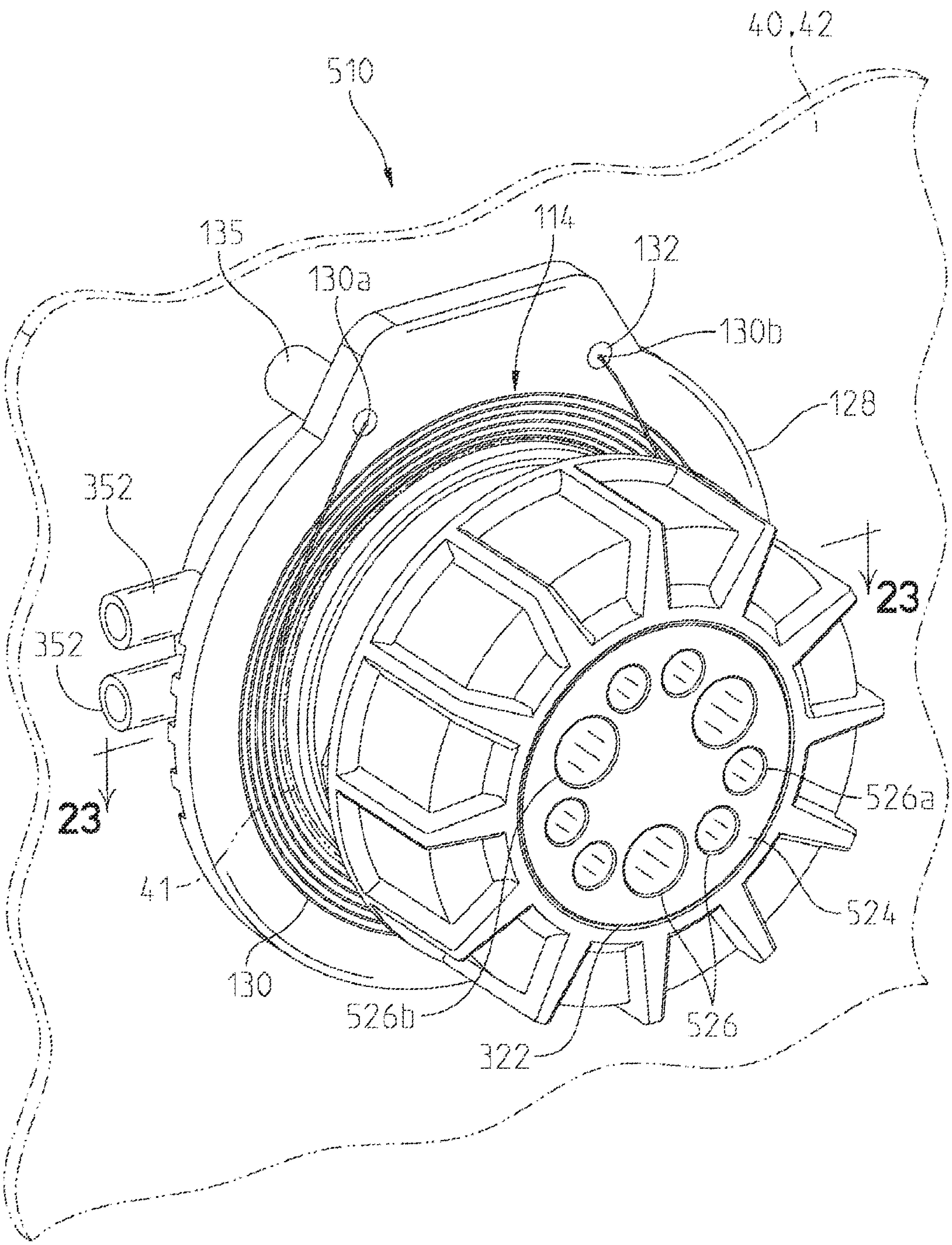
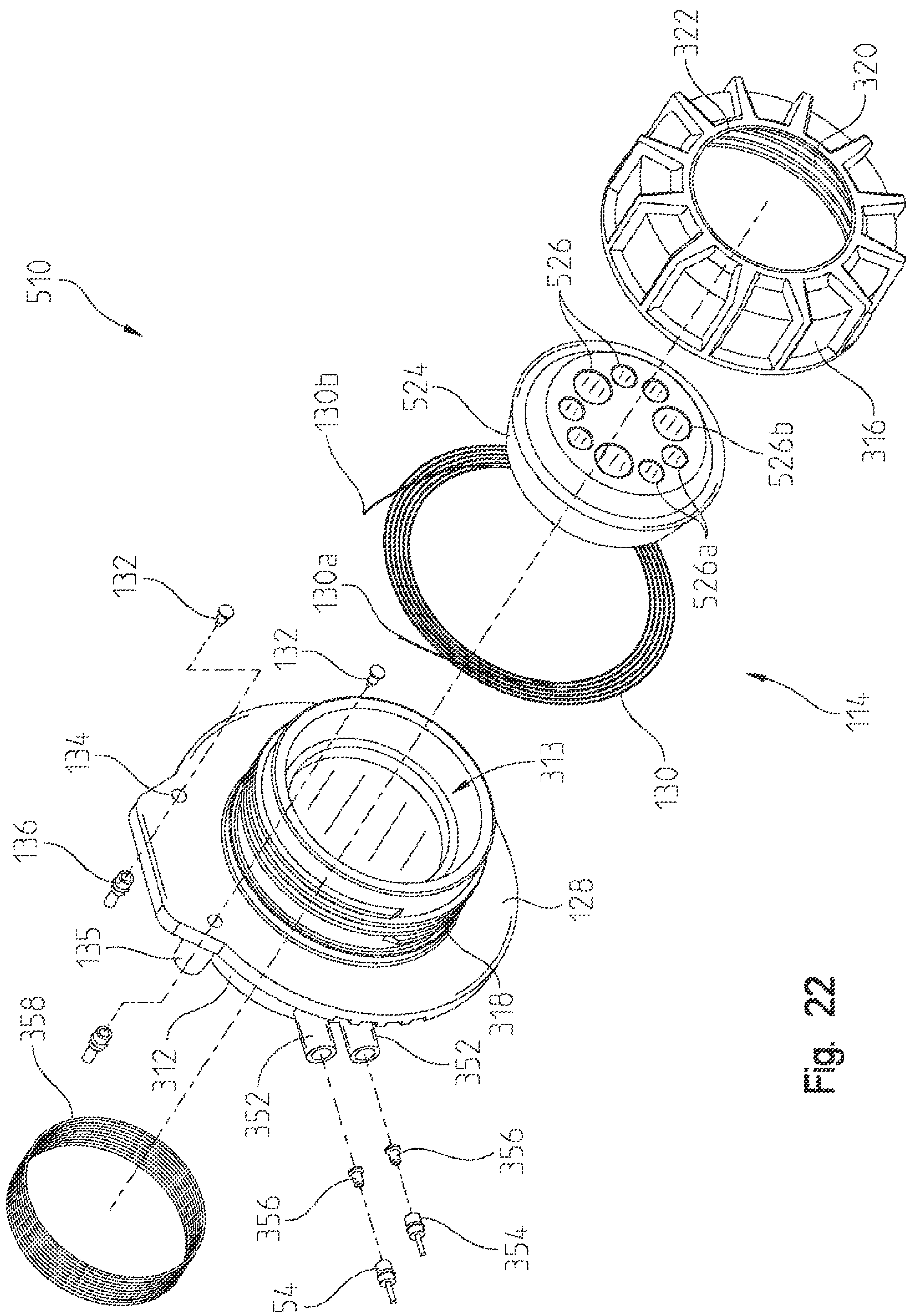

410
114
40,42
128
316
320
372
130
322
370
426
358
313
424
8,10
426
440
380
312
41
318

Fig. 20



510
40,42
114
135
130a
132
130b
128
352
352
23
23
526a
41
524
130
526b
526
322

Fig. 21



510
322
320
526
524
130b
316
526b
526a
132
130a
132
114
134
313
130
136
135
128
318
358
312
352
352
356
356
354
354

Fig. 22

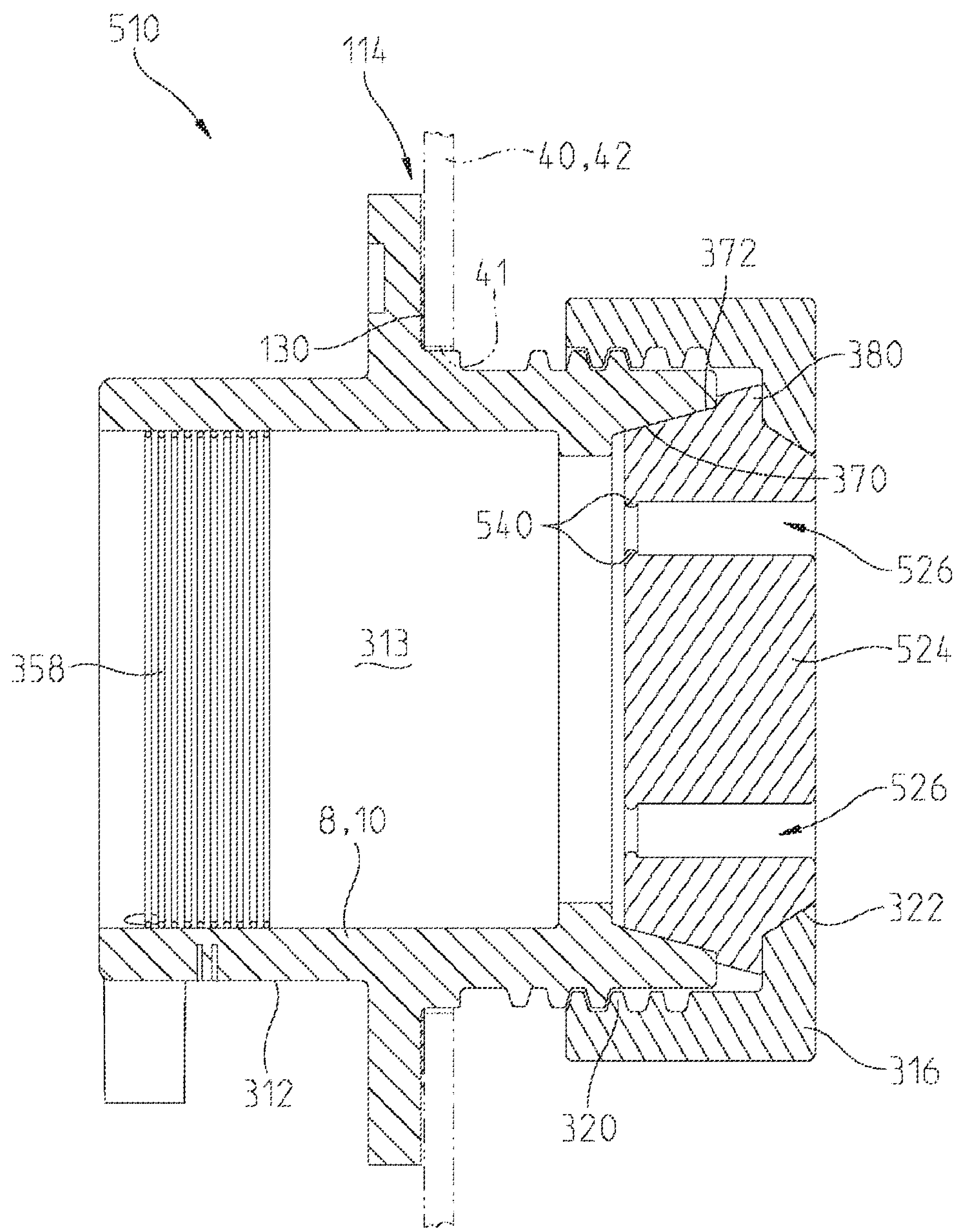

510
114
40,42
41
372
130
380
370
540
526
313
524
358
526
8,10
322
312
316
320

Fig. 23

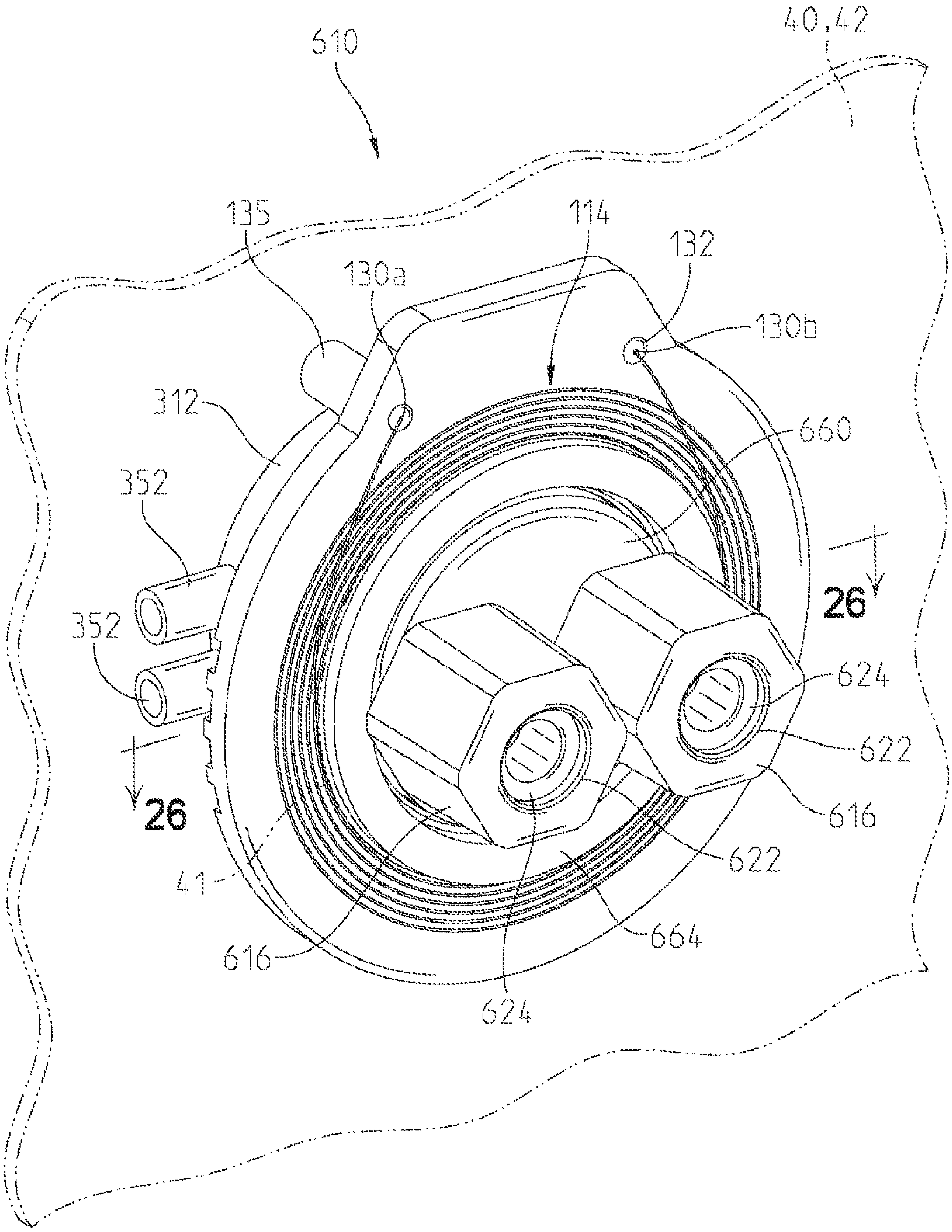

610
40,42
135
114
132
130a
130b
312
660
352
352
26
624
622
26
616
622
41
664
616
624

Fig. 24

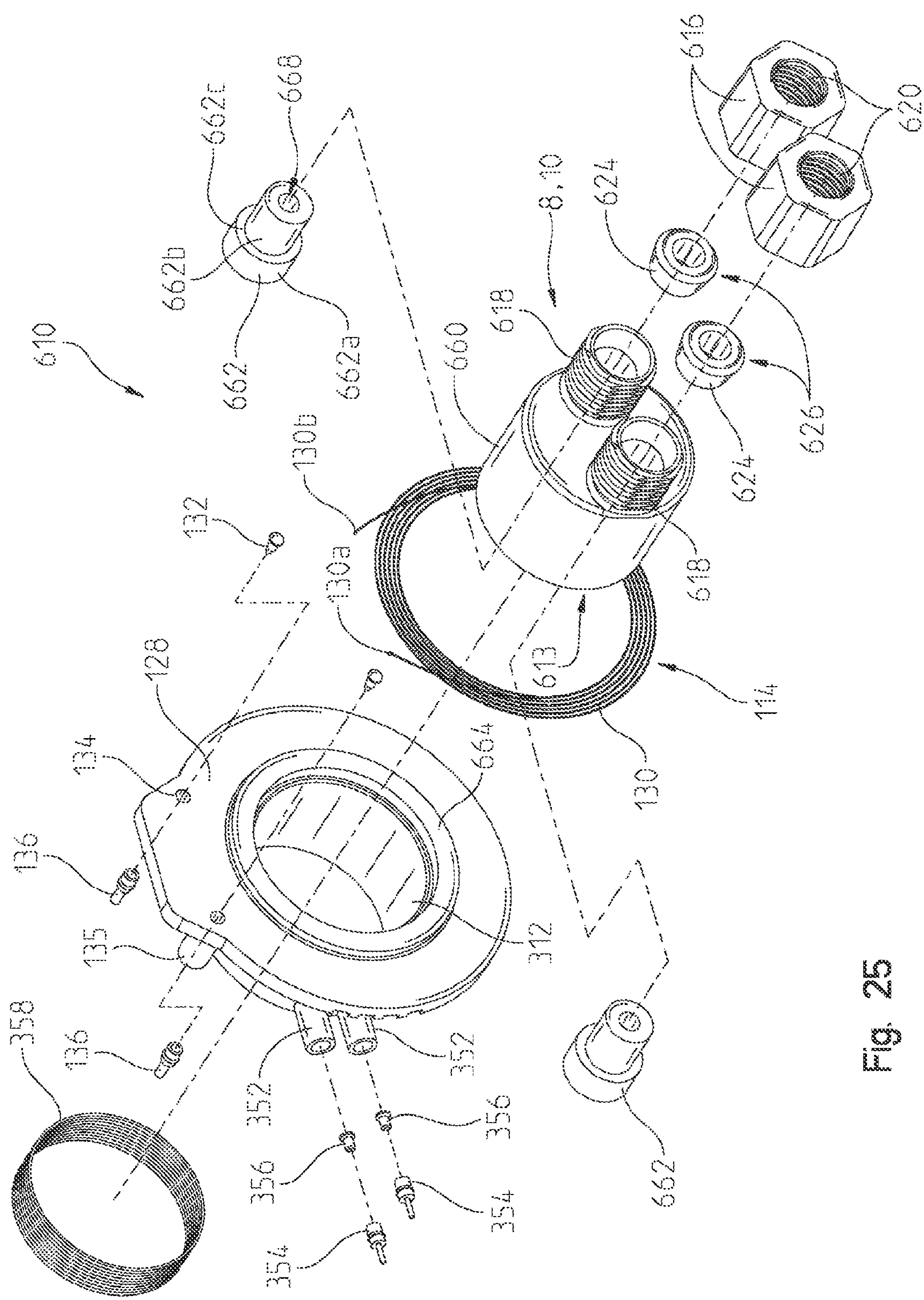
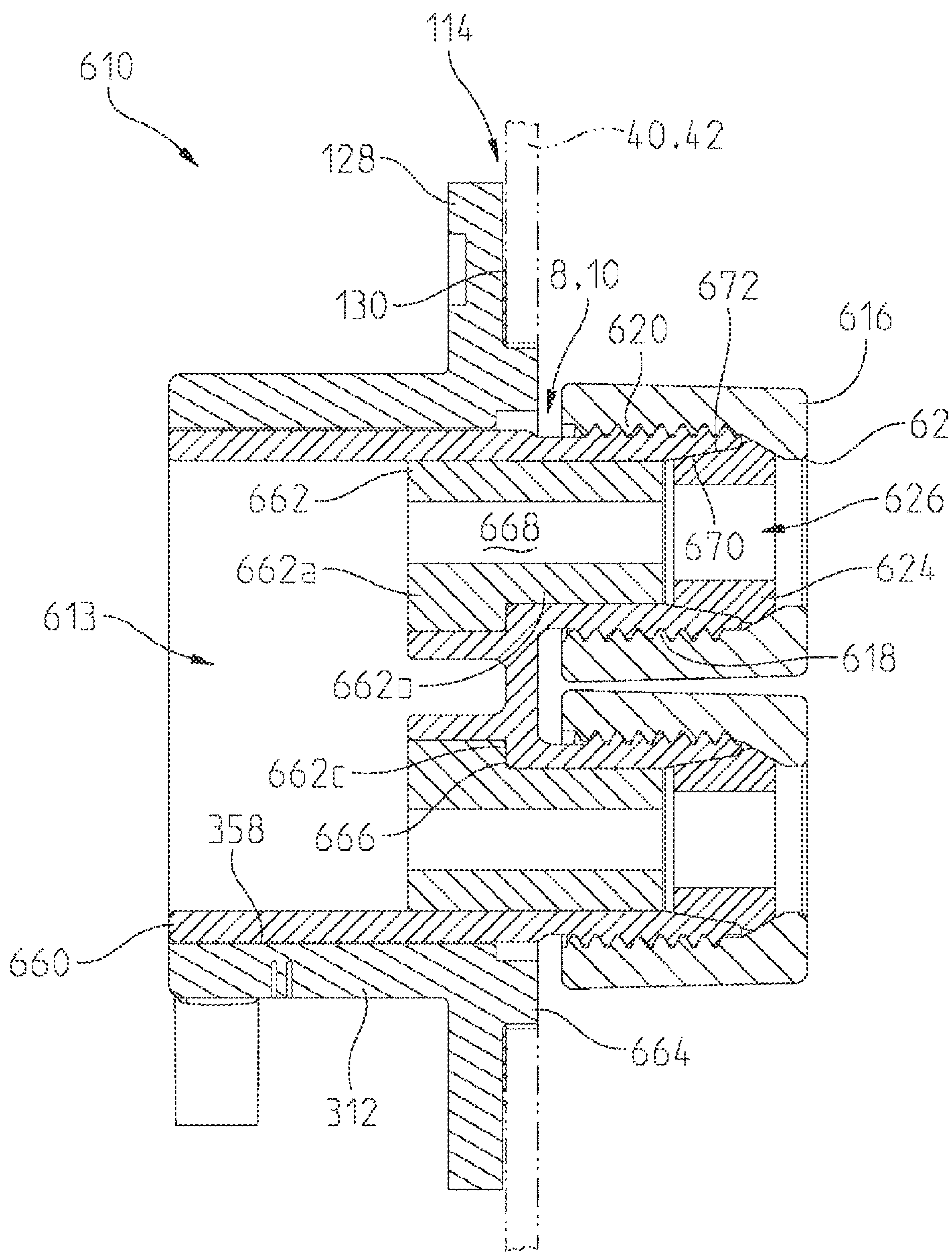

610
662
662a
662b
662c
668
616
620
8, 10
624
626
624
618
660
618
130b
132
130a
613
114
130
128
134
136
135
664
312
136
358
352
352
356
356
354
354
662

Fig. 25



610
114
40.42
128
130
8,10
672
620
616
622
662
668
626
670
662a
624
613
618
662b
662c
666
358
660
664
312

Fig. 26

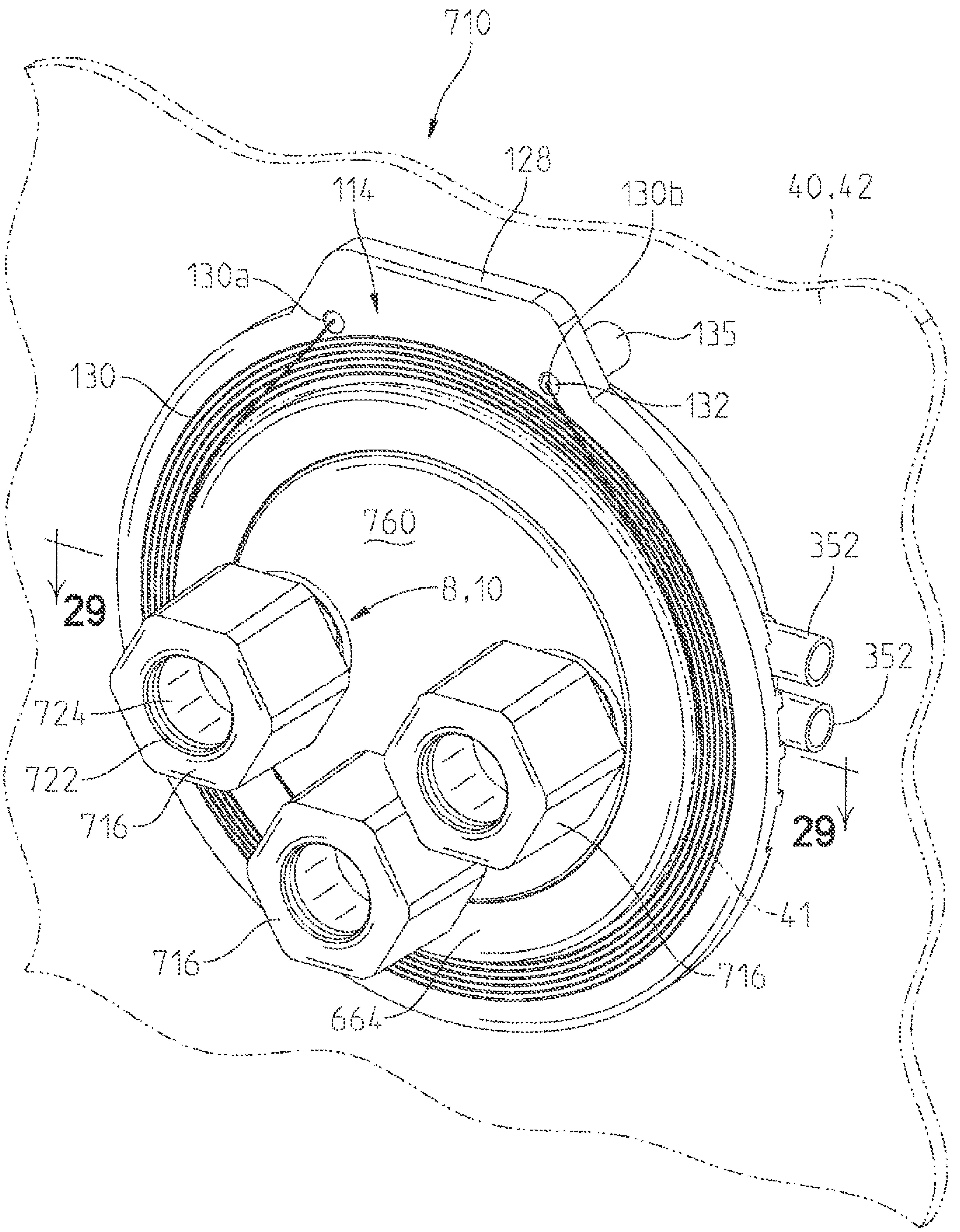

710
128
114
130b
40,42
130a
135
130
132
760
352
29
8,10
352
724
722
716
29
41
716
716
664

Fig. 27

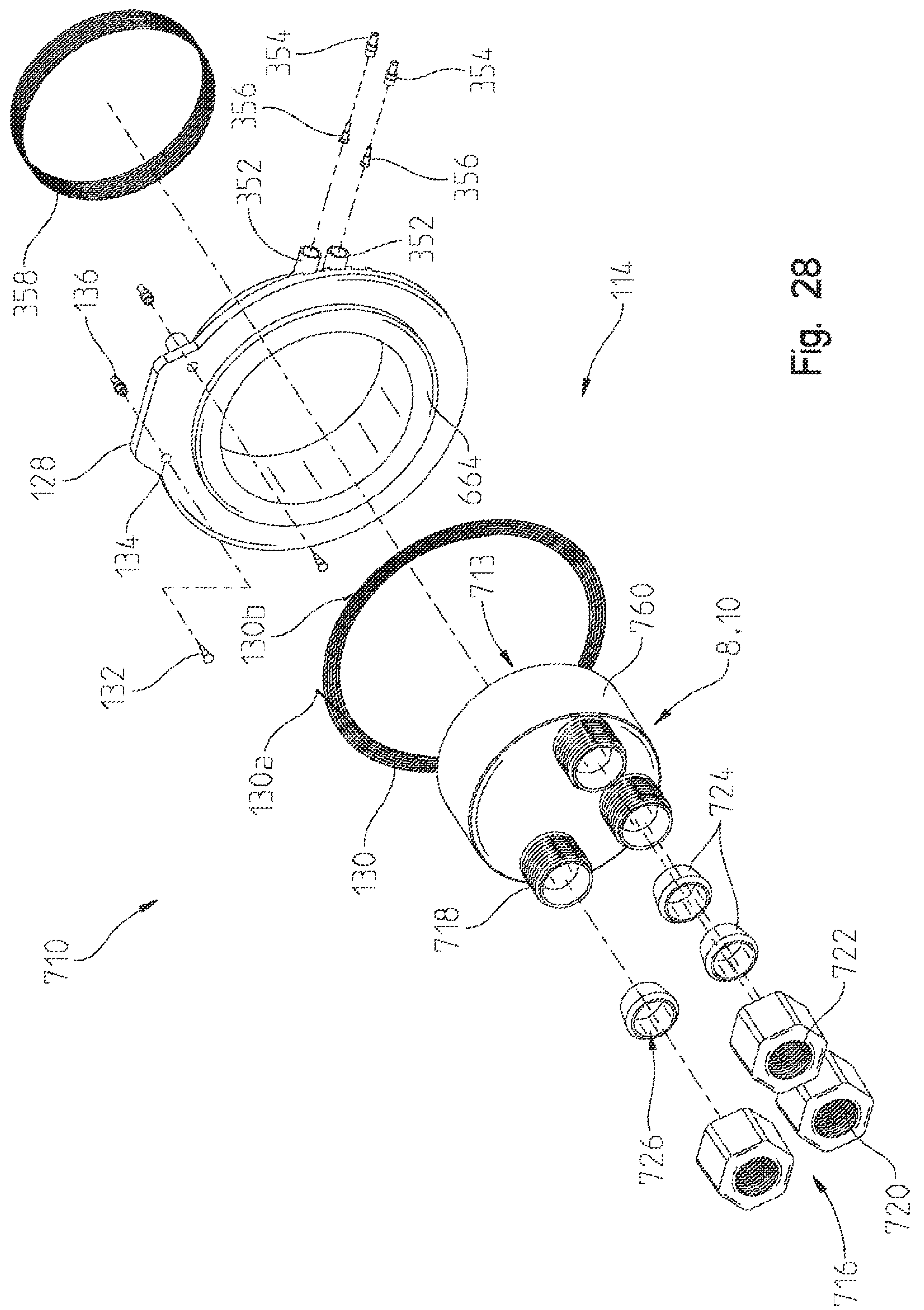

358
136
354
354
356
356
352
352
114
128
134
664
130b
132
713
760
8,10
130a
130
724
718
710
722
726
720
716

Fig. 28

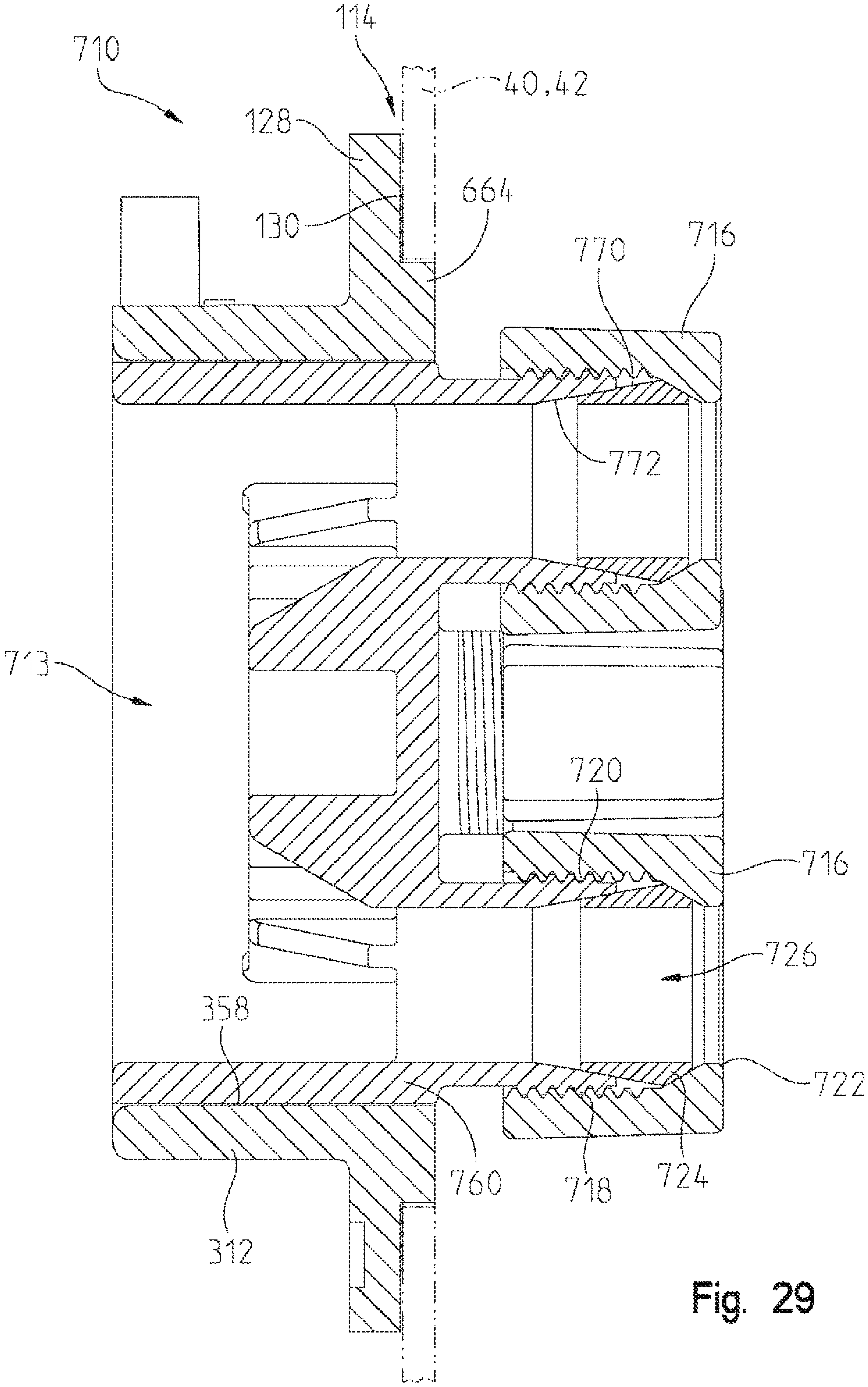

710
114
40,42
128
130
664
770
716
772
713
720
716
726
358
722
760
718
724
312

Fig. 29

ELECTRONIC TRANSITION CHAMBER

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority to U.S. Provisional Patent Application Ser. No. 62/143,424, filed on Apr. 6, 2015, and entitled "ELECTRICAL TRANSITION CHAMBER," U.S. Provisional Patent Application Ser. No. 62/143,876, filed on Apr. 7, 2015, and entitled "ELECTRICAL TRANSITION CHAMBER," and U.S. Provisional Patent Application Ser. No. 62/192,851, filed on Jul. 15, 2015, and entitled "ELECTRICAL TRANSITION CHAMBER," the complete disclosures of which are expressly incorporated by reference herein.

FIELD OF THE INVENTION

The present invention relates generally to an electrical transition chamber of a fueling system and, more particularly, to an electrical transition chamber configured to organize electrical lines based on electrical characteristics. The electrical transition chamber includes an entry seal with an electrofusion seal and a compression seal.

BACKGROUND OF THE DISCLOSURE

Transition chambers or sumps may be included in fueling systems to transition pipe lines, wires, electrical lines, or other conduits between various components. For example, electrical transition chambers are included in a fueling system for electrically connecting sensors and other electrical components on fuel tanks and the fuel dispensers to each other and the kiosk power supply and fuel management systems in a fueling service station. In this way, electrical transition chambers receive various electrical lines from portions of the fuel tanks and route the electrical lines to dispensers or other components or systems at the fueling service station.

Current electrical transition chambers may be configured to receive only one type electrical line. For example, a fueling system may include one electrical transition chamber for low-voltage electrical lines and a separate electrical transition chamber for high-voltage electrical lines. As such, current fueling systems may require at least two electrical transition chambers.

Additionally, current electrical transition chambers may have a flat or planar bottom surface on which the electrical lines are positioned. More particularly, the electrical lines are positioned on the same surface on which a person may step if accessing the electrical transition chamber. As such, if a person accesses an electrical transition chamber to repair, replace, and/or reorganize the electrical lines therein, the person may inadvertently step on the electrical wires.

SUMMARY OF THE DISCLOSURE

In one embodiment, a chamber for a fueling system comprises a housing having a lower surface and including at least one raised portion and at least one recessed portion, a plurality of inlets to the housing, and a plurality of outlets from the housing. Electrical wires which extend between the inlets and the outlets are positioned within the at least one recessed portion. A service technician may step atop the raised portion without the disturbing an electrical line positioned in the recessed portion.

In another embodiment, a chamber for a fueling system comprises a housing having a first wall, a second wall opposite the first wall, a third wall coupled to the first and second wall, a fourth wall opposite the third wall, and a lower surface coupled to the first, second, third, and fourth walls. Additionally, the chamber comprises a first support member positioned on the first wall, a second support member positioned on the first wall and spaced apart from the first support member, a third support member positioned on the second wall, and a fourth support member positioned on the second wall and spaced apart from the third support member. The chamber further comprises a plurality of inlets to the housing and a plurality of outlets from the housing. The electrical transition panel also comprises a panel configured to be positioned within the housing and supported by the first, second, third, and fourth support members. The panel includes a fifth support member configured to engage the lower surface of the housing.

In a further embodiment, a fitting for sealing an opening through a wall forming a part of a fueling system comprises a first surface and a heating element positioned to heat the first surface of the fitting and the wall forming a part of the fueling system when the fitting is operably positioned adjacent the opening in the wall. Heating the first surface of the fitting and the wall with the heating element causes the fitting and the wall to bond and form a seal therebetween. The fitting also comprises a compression fitting.

Additional features and advantages of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of the illustrative embodiments exemplifying the best mode of carrying out the invention as presently perceived.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and many of the intended advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description when taken in conjunction with the accompanying drawings.

FIG. **1** is a perspective view of a chamber for a fueling system;

FIG. **2** is a further perspective view of the chamber of FIG. **1**, with a portion of an access cover removed;

FIG. **3** is an exploded view of the chamber of FIG. **1**;

FIG. **4** is a cross-sectional view of a portion of an access cover of the chamber of FIG. **1**, taken along line **4-4** of FIG. **1**;

FIG. **5** is a perspective view of a housing of the chamber of FIG. **1** with the access cover removed and a cut-away exposing an interior volume and a segregation panel of the housing;

FIG. **6** is a further perspective view of the housing of the chamber of FIG. **5** with a further cut-away exposing the interior volume and the segregation panel;

FIG. **7** is a cross-sectional view of the housing and panel of FIG. **5**, taken along line **7-7** of FIG. **5**;

FIG. **8** is a top view of the chamber of FIG. **1** with the access cover removed and including a plurality of electrical lines electrically coupled to various components of the fueling system;

FIG. **9** is a perspective view of a first embodiment of an entry seal for an inlet and/or an outlet of the chamber of FIG. **1**;

FIG. **10** is an exploded view of the first embodiment entry seal of FIG. **9**;

FIG. **11** is a cross-sectional view of the first embodiment entry seal of FIG. **9**, taken along line **11-11** of FIG. **9**;

FIG. **12** is a perspective view of a second embodiment of an entry seal for the inlet and/or outlet of the chamber of FIG. **1**;

FIG. **13** is an exploded view of the second embodiment entry seal of FIG. **12**;

FIG. **14** is a cross-sectional view of the second embodiment entry seal of FIG. **12**, taken along line **14-14** of FIG. **12**;

FIG. **15** is a perspective view of a third embodiment of an entry seal for the inlet and/or outlet of the chamber of FIG. **1**;

FIG. **16** is an exploded view of the third embodiment entry seal of FIG. **15**;

FIG. **17** is a cross-sectional view of the third embodiment entry seal of FIG. **15**, taken along line **17-17** of FIG. **15**;

FIG. **18** is a perspective view of a fourth embodiment of an entry seal for the inlet and/or outlet of the chamber of FIG. **1**;

FIG. **19** is an exploded view of the fourth embodiment entry seal of FIG. **18**;

FIG. **20** is a cross-sectional view of the fourth embodiment entry seal of FIG. **18**, taken along line **20-20** of FIG. **18**;

FIG. **21** is a perspective view of a fifth embodiment of an entry seal for the inlet and/or outlet of the chamber of FIG. **1**;

FIG. **22** is an exploded view of the fifth embodiment entry seal of FIG. **21**;

FIG. **23** is a cross-sectional view of the fifth embodiment entry seal of FIG. **21**, taken along line **23-23** of FIG. **21**;

FIG. **24** is a perspective view of a sixth embodiment of an entry seal for the inlet and/or outlet of the chamber of FIG. **1**;

FIG. **25** is an exploded view of the sixth embodiment entry seal of FIG. **24**;

FIG. **26** is a cross-sectional view of the sixth embodiment entry seal of FIG. **24**, taken along line **26-26** of FIG. **24**;

FIG. **27** is a perspective view of a seventh embodiment of an entry seal for the inlet and/or outlet of the chamber of FIG. **1**;

FIG. **28** is an exploded view of the seventh embodiment entry seal of FIG. **27**; and

FIG. **29** is a cross-sectional view of the seventh embodiment entry seal of FIG. **27**, taken along line **29-29** of FIG. **27**.

Corresponding reference characters indicate corresponding parts throughout the several views. Although the drawings represent embodiments of various features and components according to the present disclosure, the drawings are not necessarily to scale and certain features may be exaggerated in order to better illustrate and explain the present disclosure. The exemplification set out herein illustrates an embodiment of the invention, and such an exemplification is not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION OF THE DRAWINGS

For the purposes of promoting an understanding of the principals of the invention, reference will now be made to the embodiments illustrated in the drawings, which are described below. The embodiments disclosed below are not intended to be exhaustive or limit the invention to the precise form disclosed in the following detailed description. Rather, the embodiments are chosen and described so that others skilled in the art may utilize their teachings. It will be understood that no limitation of the scope of the invention is thereby intended. The invention includes any alterations and further modifications in the illustrative devices and described methods and further applications of the principles of the invention which would normally occur to one skilled in the art to which the invention relates.

Referring to FIGS. **1-4**, a chamber or sump **2** for a fuel system **100** (FIG. **8**) is configured to receive a plurality of electrical lines or wires **90**, as disclosed further herein. In one embodiment, chamber **2** may be an electrical transition chamber or a tank chamber for fuel system **100** (FIG. **8**). Electrical lines **90** are routed through chamber **2** but do not terminate at or in chamber **2**. Illustratively, chamber **2** includes an access cover **4**, a housing **6**, a plurality of inlets **8**, and a plurality of outlets **10**. Means for providing a vapor-tight seal between inlets **8** and electrical lines **90** and outlets **10** and electrical lines **90** are provided to prevent vapors from being transmitted through inlets and outlets **8**, **10**. Chamber **2** may be positioned within the ground such that only access cover **4** is exposed. Access cover **4** is removably coupled to housing **6** with a plurality of fasteners **20**, for example bolts **20*a*** and washers **20*b***. A seal or gasket **22** may be positioned intermediate housing **6** and access cover **4** when access cover **4** is coupled to housing **6**. More particularly, gasket **22** includes a plurality of apertures **24** configured to receive bolts **20*a*** as bolts **20*a*** extend through a portion of housing **6** and into access cover **4**.

As shown in FIGS. **3** and **4**, access cover **4** may be comprised of a polymeric material and, illustratively, is comprised of a glass-reinforced polymeric material. Access cover **4** includes an upper cover member **12**, a seal **14**, a body member or frame **16**, and plurality of retaining members **18**. Frame **16** may have a tapered configuration with a lower end **16*b*** which is wider than a top end **16*a***. In use, upper cover member **12** is positioned within a portion of top end **16*a*** of frame **16** such that upper cover member **12** is generally flush with top end **16*a*** of frame **16**. Seal **14** may be positioned within a groove **26** of upper cover member **12** to sealingly couple upper cover member **12** to frame **16**. Additionally, a locking member **28** may be included on upper cover member **12** to lock upper cover member **12** to frame **16**. In one embodiment, locking member **28** may be locked and unlocked with a tool, such as a screwdriver and/or a wrench. Alternatively, locking member **28** may be locked and unlocked with a unique key specific to locking member **28**.

Frame **16** also may include retaining members **18**, which as shown in FIG. **4**, may be embedded within a portion of frame **16**. Illustratively, retaining members **18** may be positioned adjacent lower end **16*b*** of frame **16**. Retaining members **18** include apertures **38** which have threads or another retaining mechanism for coupling with bolts **20*a***. More particularly, as shown in FIGS. **3** and **4**, when coupling access cover **4** to housing **6**, bolts **20*a*** extend through apertures **32** of a coupling member **30** positioned below a flange **34** of housing **6**. Washers **20*b*** may be positioned intermediate the head of bolts **20*a*** and coupling member **30**. Bolts **20*a*** further extend through apertures **36** of flange **34** and apertures **24** of gasket **22** and into apertures **38** of retaining members **18** to secure access cover **4** to housing **6**. When accessing housing **6**, access cover **4** may be removed by removing fasteners **20**. Alternatively, housing **6** may be accessed by unlocking locking member **28** and removing upper cover member **12** from frame **16**.

Referring to FIGS. **1-3**, illustrative housing **6** is a unitary structure which includes a first wall **40**, a second wall **42** generally opposite first wall **40**, a third wall **44** spanning first and second walls **40** and **42**, a fourth wall **46** generally opposite third wall **44** and spanning first and second walls **40** and **42**, and a lower surface or wall **48** from which first, second, third, and fourth walls **40**, **42**, **44**, **46** extend. Walls **40**, **42**, **44**, **46**, **48** generally enclose a singular interior space or volume **50**. Illustrative housing **6** generally defines a cube, however, alternative embodiments of housing **6** may have other polygonal configurations (e.g., a triangle, pentagon, octagon, or hexagon in cross-section). As such, walls **40**, **42** may be directly coupled to walls **44**, **46** to form a cube or may be indirectly coupled to walls **44**, **46** through additional walls (not shown) to form any other polygonal structure. Walls **40**, **42**, **44**, **46** extend between flange **34** and lower wall **48**. In one embodiment, walls **40**, **42**, **44**, **46** have a height of 500-1200 mm and, more particularly, 700-900 mm, which allows electrical lines **90** to be positioned below the ground by a minimum depth of 500 mm. Housing **6** may be comprised of a polymeric material, for example polyethylene or any other similar material.

Referring to FIGS. **1-3** and **8**, first wall **40** includes inlets **8** and second wall **42** includes outlets **10**. Inlets **8** define conduits to receive electrical lines **90** from a portion of fuel system **100**, such as electrical components (e.g., sensors, processors) on fuel tanks or fuel chambers **100***a* (FIG. **8**). Electrical lines **90** extend into interior volume **50** of housing **6** and pass through outlets **10**, which define conduits for electrically coupling with a second portion of fuel system **100**, such as electrical components (e.g., sensors, processors) on dispensers **100***b* or other components at a fuel service station. Electrical lines **90** extending into housing **6** through inlets **8** and out of housing **6** through outlets **10** may have varying voltages such that a first plurality of electrical lines **90** may be low-voltage lines or cables **92**, such as intrinsically-safe cables, and a second plurality of electrical lines **90** may be high-voltage line or cables **94**, such as data and power cables. Inlets **8** and outlets **10** may be sealed against first wall **40** and second wall **42**, respectively, through electro-fusion welding or other similar methods and protrude outwardly therefrom. In this way, housing **6** is sealed against moisture, debris, and other matter. Inlets and outlets **8**, **10** are further sealed so as to reduce or inhibit the transfer of vapors from the chambers of fuel tanks **100***a* (FIG. **8**), sumps on dispensers **100***b* (FIG. **8**), or other portions of the fuel station.

Referring to FIGS. **5** and **6**, first and second wall **40**, **42** each also includes an upper support member **52** extending into interior volume **50** of housing **6**, as detailed further herein. Illustratively, upper support members **52** are positioned above inlets **8** and outlets **10**. In one embodiment, upper support members **52** may define tabs extending into interior volume **50**.

Referring to FIGS. **5-7**, third and fourth walls **44**, **46** of housing **6** span first and second walls **40**, **42** but do not include inlets or outlets **8**, **10**. Rather, third and fourth walls **44**, **46** include stabilizing or support members **54** protruding outwardly therefrom and join to a portion of lower wall **48** of housing **6**. Illustratively, support members **54** are positioned proximate a lower end of third and fourth walls **44**, **46** for coupling with lower wall **48**. In one embodiment, support members **54** are comprised of the same material as housing **6** and weights may be positioned thereon or otherwise attached thereto to stabilize housing **6**, as detailed further herein. Alternatively, support members **54** may be comprised of a metallic or ceramic material (e.g., concrete) and have a weight greater than the weight of housing **6** to stabilize housing **6**. More particularly, during operation of fuel system **100**, coils (not shown) on electrical lines **90** may have shape memory and, therefore, may move to a default position. Movement of the coils may cause movement of housing **6**. However, by providing support members **54**, housing **6** may be stabilized during operation of fuel system **100**. In one embodiment, support members **54** are included on housing **6** through conventional processes, such as welding. Alternatively, support members **54** may be integrally formed with housing **6**.

Referring to FIGS. **5-8**, lower wall **48** of housing **6** is joined with first, second, third, and fourth walls **40**, **42**, **44**, **46**. Lower wall **48** includes at least one raised portion **56** and at least one recessed portion **58**. Illustratively, lower wall **48** includes a plurality of recessed portions **58** alternatively arranged with a plurality of raised portions **56** such that raised portions **56** define platforms of lower wall **48** and recessed portions **58** define troughs of lower wall **48**. Recessed portions **58** define the lower-most surface of housing **6** and are positioned adjacent at least one raised portion **56**. As disclosed herein, recessed portions **58** define a routing tray for electrical lines **90**.

As shown in FIG. **8**, raised portions **56** include a first plurality **64** positioned adjacent first wall **40** and second plurality **66** positioned adjacent second wall **42**. A channel **68** is defined intermediate first and second pluralities **64**, **66** of raised portions **56**. Illustrative channel **68** has a width E extending between first and second pluralities **64**, **66** of raised portions **56** of approximately 130-160 mm and, more particularly, 144 mm.

As shown in FIG. **8**, raised portions **56** have a tapered configuration such that an inner end **60** of raised portions **56** may have a width A which is less than width B of an outer end **62**. In one embodiment, width A of inner end **60** is 80-110 mm and width B of outer end **62** is 85-115 mm. Illustratively, width A of inner end **60** is 96 mm and width B of outer end of 103 mm. The narrowing width of raised portions **56** may define a 1° taper from outer end **62** to inner end **60**. A length D of raised portions **56** extending from inner end **60** to outer end **62** may be 200-300 mm and, more particularly, 250 mm. Additionally, as shown in FIG. **7**, a height C of raised portions **56** may be 35-65 mm and, more particularly, may be 50 mm.

Referring to FIGS. **5-8**, housing **6** may further include lower support members **70** extending inward within interior volume **50** from first and second walls **40**, **42**. Lower support members **70** are positioned adjacent lower wall **48** and are spaced apart from upper support members **52**. Illustratively, each lower support member **70** may be integrally formed with one of raised portions **56** or, alternatively, may be coupled thereto through conventional methods (e.g., welding). Lower support members **70** extend upwardly from raised portions **56** and may have a width of approximately half the width of raised portions **56**, as shown in FIG. **7**.

Referring still to FIGS. **5-8**, chamber **2** includes a segregation panel or plate **72** removably positioned within interior volume **50** of housing **6**. To facilitate removing segregation panel **72** from housing **6**, segregation panel **72** may include an opening **84** defining a handle for pulling segregation panel **72** from housing **6**. Segregation panel **72** is provided within housing **6** to define separate sections of unitary housing **6** for separating electrical lines **90** based on various electrical properties (e.g., voltage, current, size). More particularly, segregation panel **72** defines a first section **74** for low-voltage cables **92** and a second section **76** for high-voltage cables **94**. In this way, housing **6** remains a singular or unitary structure with a single interior volume **50** but segregation panel **72** creates separation between low-voltage cables **92** and high-voltage cables **94**.

Segregation panel **72** may be comprised of a metallic, polymeric, or ceramic material. In one embodiment, segregation panel **72** is comprised of a galvanized metallic material. Illustrative segregation panel **72** has a thickness F (FIG. **7**) of 1-20 mm and, more particularly, 3 mm. Segregation panel **72** is received within interior volume **50** of housing **6** and positioned above two raised portions **56** such that segregation panel **72** extends the full distance between first and second walls **40**, **42** (FIG. **8**). However, the height of segregation panel **72** is less than the height of first and second walls **40**, **42**. More particularly, the top end of segregation panel **72** may be positioned approximately 90 mm below flange **34** of housing **6**. Alternatively, the height of segregation panel **72** may fully extend to flange **34** or may be more than 90 mm below flange **34**, depending on the application and configuration of chamber **2**.

To accommodate raised portions **56**, segregation panel **72** includes two cut-out or recessed portions **78** sized to generally extend above and around raised portions **56**. In this way, segregation panel **72** is positioned within housing **6** such that cut-out portions **78** of segregation panel **72** are positioned around at least a portion of raised portions **56**. Additionally, segregation panel **72** includes an elongated portion **80** intermediate cut-out portions **78**. Elongated portion **80** is integrally formed with segregation panel **72** and extends to channel **68** of housing **6** when segregation panel **72** is positioned therein. Elongated portion **80** includes a tab **82** extending perpendicularly therefrom. Tab **82** is configured to contact and extend along a portion of channel **68** and remain in contact with lower wall **48** when segregation panel **72** is positioned within housing **6**.

Segregation panel **72** is stabilized within housing **6** by tab **82** because tab **82** rests on channel **68**. More particularly, because segregation panel **72** includes cut-out portions **78** for extending over raised portions **56**, tab **82** may be flush against channel **68**. Additionally, segregation panel **72** is stabilized within housing **6** by upper support members **52** and lower support members **70**. As shown in FIG. **8**, upper support member **52** on first wall **40** is positioned along one side of segregation panel **72** and upper support member **52** on second wall **42** is positioned along the other side of segregation panel **72**. As such, segregation panel **72** is retained between upper support members **52**. Similarly, segregation panel **72** is retained between lower support members **70** because, as shown in FIG. **8**, lower support member **70** on first wall **40** is positioned along one side of segregation panel **72** and lower support member **70** on second wall **42** is positioned along the other side of segregation panel **72**. Illustratively, as shown in FIG. **8**, upper support member **52** and lower support member **70** on first wall **40** are positioned on opposite sides of segregation panel **72** and upper support member **52** and lower support member **70** on second wall **42** also are positioned on opposite sides of segregation panel **72**. In this way, segregation panel **72** is retained between upper and lower support members **52**, **70** on first and second walls **40**, **42**. As such, segregation panel **72** is stabilized within housing **6** and remains in the position shown in FIGS. **7** and **8** but is not permanently coupled within housing **6** so that segregation panel **72** may be removed from housing **6**.

Referring still to FIG. **8**, segregation panel **72** is supported at opposite corners by upper and lower support members **52**, **70**. More particularly, upper support member **52** on first wall **40** and lower support member **70** on second wall **42** are positioned substantially within a plane P1 extending perpendicularly between the first and second walls, within manufacturing tolerances. Additionally, upper support member **52** on second wall **42** and lower support member **70** on first wall **40** are positioned substantially within a plane P2 extending perpendicularly between the first and second walls, within manufacturing tolerances. By separating upper support members **52** at opposite walls **40**, **42** and separating lower support members **70** at opposite walls **40**, **42**, chamber **2** may be formed during a molding process (e.g., roto-molding or rotational molding) without additional process steps, such as a machining step. For example, if upper support members **52** were both positioned on wall **40**, a small gap would be required to receive segregation panel **72**. However, such a small gap may be difficult to form during a molding process, so additional processing, such as machining, would be necessary after the molding process to form the gap for segregation panel **72**. But, because upper support members **52** are positioned on opposite walls **40**, **42**, chamber **2** may be formed through a molding process without additional processing steps.

As shown in FIG. **8**, chamber **2** is electrically coupled to various components of fuel system **100**, such as fuel tanks **100*a*** and dispensers **100*b*** at a fueling service station. To electrically connect sensors, processors, and/or other electrical components on fuel tanks **100*a*** to sensors, processors, and/or other electrical components on dispensers **100*b***, chamber **2** is positioned within the ground with access cover **4** generally flush with the ground. Inlets **8** of chamber **2** receive electrical lines **90** from fuel tanks **100*a***. Electrical lines **90** extending into housing **6** from fuel tanks **100*a*** include low-voltage cables **92** and high-voltage cables **94**. To organize electrical lines **90** according to its type, purpose, location, or any other electrical lines **90** may be organized into a group(s) of low-voltage cables **92** positioned on one side of segregation panel **72** and a group(s) of high-voltage cables **94** on the other side of segregation panel **72**. More particularly, electrical lines **90** are routed into desired groupings through recessed portions **58** and channel **68** on both sides of segregation panel **72** but are not positioned on raised portions **56**.

Once electrical lines **90** are organized into various groupings within housing **6** and segregation panel **72** separates low-voltage cables **92** (e.g., intrinsically-safe cables) from high-voltage cables **94** (e.g., power and data cables), electrical lines **90** are received through outlets **10** and electrically connect with various electrical components at fuel dispensers **100*b*** of the service station. While described within electrical lines **90** extending between a fuel tank and fuel dispensers **110*b***, electrical lines **90** may extend between any other components of a fueling installation.

If access to electrical lines **90** is necessary, access cover **4** may be removed to expose electrical lines **90**. More particularly, either the full access cover **4** may be removed or only upper cover member **12** may be removed. Once electrical lines **90** are exposed, the person accessing electrical lines **90** may step into chamber **2** to repair, replace, service, and/or reorganize electrical lines **90**. In particularly, raised portions **56** do not include any electrical lines **90** such that the person accessing chamber **2** may step on raised portions **56** without stepping on electrical lines **90** which are routed along recessed portions **58** and channel **68**. As such, the structure, materials, and configuration of raised portions **56** are configured to support the weight of a technician. For example, the raised portions **56** may be configured to support a weight of up to 300 lbs.

Referring to FIGS. **9**-**29**, various embodiments of an entry seal for inlets **8** and/or outlets **10** of chamber **2** are shown.

More particularly, the illustrative entry seals include a combination of an electrofusion seal and a removable compression seal. In this way, the entry seals are fused to first and/or second walls **40**, **42** of chamber **2** through the electrofusion seal while maintaining access to electrical lines **90** through the removable compression seal, as disclosed further herein. The illustrative entry seals provide a barrier to fluids and vapors entering interior volume **50** (FIG. **2**) of chamber **2**.

As shown in FIGS. **9-11**, a first embodiment of an entry seal **110** includes a conduit **112** cooperating with inlet **8** and/or outlet **10** to define a passageway **113** for electrical lines **90** to pass into and out of chamber **2**. In one embodiment, a socket welding or fitting (not shown) may be provided to facilitate coupling between conduit **112** and inlet **8** and/or outlet **10** or to facilitate coupling between conduit **112** and any other conduit for electrical lines **90**. In one embodiment, conduit **112** is comprised of a polymeric material, such as high-density polyethylene. Entry seal **110** is configured to couple with first wall **40** or second wall **42** such that an opening **41** through wall **40**, **42** receives conduit **112**. Conduit **112** is configured to receive one or more electrical lines **90**.

Additionally, entry seal **110** includes an electrofusion seal **114** and a compression seal or fitting, defined as a compression nut **116**. Illustratively, electrofusion seal **114** is positioned on one side of wall **40**, **42** and compression nut **116** positioned on the opposite side of wall **40**, **42**, however, both electrofusion seal **114** and compression nut **116** may be positioned on the same side of wall **40**, **42**. In one embodiment, compression nut **116** defines a compression nut. Compression nut **116** may be comprised of a polymeric material, such as a nylon material, and is removably coupled to inlets **8** and/or outlets **10**. More particularly, compression nut **116** includes internal threads **120** which are threadedly coupled to external threads **118** on inlet **8** and/or outlet **10**. Because compression nut **116** is removable from inlet **8** and/or outlet **10** by unscrewing internal threads **120** from external threads **118**, electrical lines **90** extending through passageway **113** are accessible for installing, removing, repairing, or replacing electrical lines **90**.

As shown in FIGS. **9-11**, the compression seal further includes a grommet **124** may be positioned within a portion of compression nut **116** and inlet **8** and/or outlet **10** for sealingly maintaining electrical lines **90** within passageway **113**. For example, grommet **124** may be a vapor seal configured to seal interior volume **50** (FIG. **2**) of chamber **2** from vapors. Grommet **124** includes at least one open channel **126** which aligns with at least one opening **122** on compression nut **116** and passageway **113** to allow electrical lines **90** or a conduit carrying electrical lines **90** to extend through channel **126** and into and out of chamber **2**. Grommet **124** also may have a slot (not shown) in channels **126** for accessing electrical lines **90**. Illustratively, grommet **124** has a tapered surface **170** which abuts a complementary tapered surface **172** of inlet **8** and/or outlet **10**. In one embodiment, grommet **124** is comprised of a polymeric material, for example a rubber material.

In addition to compression nut **116**, entry seal **110** also includes electrofusion seal **114**. Electrofusion seal **114** is supported on a support member **128** of entry seal **110** which is configured to abut wall **40**, **42** of chamber **2**. In one embodiment, support member **128** defines a flange. Electrofusion seal **114** includes electrofusion wiring or winding **130** coupled to supported member **128** with couplers **132**. In particular, couplers **132** are operably coupled to leads **130***a*, **130***b* of electrofusion winding **130** and pins **136** of electrofusion seal **114** are coupled to couplers **132** through openings **134** and shrouds **135** of support member **128** to electrically connecting winding **130** to an exposed terminal.

When inlet **8** and/or outlet **10** is received through opening **41** in wall **40**, **42**, electrofusion winding **130** contacts one side of wall **40**, **42**. In particular, winding **130** is positioned adjacent any surfaces of entry seal **110** and chamber **2** in close proximity of each other in order to couple the adjacent surfaces together through electrofusion. For example, welder (not shown) may be connected to electrofusion winding **130** through pins **136**. During operation of the welder, current runs through electrofusion winding **130** which generates heat through resistive heating. This resistive heating generated by the current running through winding **130** is transmitted to a portion of support member **128** and a portion of wall **40**, **42**. The heat transmitted from electrofusion winding **130** melts the portions of support member **128** and wall **40**, **42** at electrofusion winding **130**. The melted portions of support member **128** and wall **40**, **42** then fuse together to permanently couple support member **128** to wall **40**, **42**. As such, support member **128** is permanently coupled to wall **40**, **42** through electrofusion seal **114** which allows at least one electrical line **90** to pass through passageway **113**; however, compression nut **116** is removable from inlet **8** and/or outlet **10** for access to electrical lines **90** when necessary. As such, entry seal **110** includes electrofusion seal **114** for permanently positioning support member **128** and conduit **112** on chamber **2** but also includes compression nut **116** for allowing access to electrical lines **90**.

Once entry seal **110** is coupled to chamber **2** through electrofusion seal **114**, electrical lines **90** may be received through entry seal **110** for routing through chamber **2**. In particular, the outer diameter of electrical lines **90** or the outer diameter of a conduit carrying electrical lines **90** is less than the inner diameter of conduit **112**, channels **126** of grommet **124**, and opening **122** of compression nut **116**. As such, electrical lines **90** pass extend through passageway **113**, through grommet **124**, and through compression nut **116**. More particularly, grommet **124** may be configured to seal against the outer diameter of one of electrical lines **90** passing through channel **126** or may be configured to seal against the outer diameter of a conduit carrying one or more electrical lines **90**. To seal interior volume **50** of chamber **2** from any vapor or fluids in passageway **113**, compression nut **116** is tightened onto inlet **8** and/or outlet **10** by rotating internal threads **120** along external threads **118**. As compression nut **116** is tightened on inlet **8** and/or outlet **10**, compression nut **116** pushes grommet **124** into inlet **8** and/or outlet **10** to form a hermetic seal to reduce the flow of any vapor or fluids from passageway **113** into interior volume **50** (FIG. **2**).

As shown in FIGS. **12-14**, a second embodiment of an entry seal **210** has corresponding features with similar construction and function to those disclosed herein with respect to entry seal **110**, with the corresponding features represented by identical reference numbers. Entry seal **210** includes first and second compression nuts **116***a*, **116***b* positioned on opposing sides of wall **40**, **42**. Additionally, entry seal **210** includes a conduit **212** which cooperates with inlet **8** and/or outlet **10** to define passageway **113** for electrical lines **90** to pass into and out of chamber **2**. Conduit **212** has exterior threads **250** for cooperating with second compression nut **116***b* to threadedly couple second compression nut **116***b* to conduit **212**. Similar to the threaded connection between inlet **8** and/or outlet **10** and first compression nut **116***a*, both compression nuts **116***a*, **116***b* are removable from entry seal **210** for access to electrical lines **90** passing therethrough. In one embodiment, compression nuts **116***a*, **116***b* are comprised of a nylon material.

As shown in FIGS. **12-14**, the compression seal of entry seal **210** also includes grommets **124***a*, **124***b* which are positioned within a portion of respective compression nuts **116***a*, **116***b* for sealingly maintaining electrical lines **90** within passageway **113**. Grommets **124***a*, **124***b* each also may have a slot (not shown) in channels **126** for accessing electrical lines **90**. In one embodiment, grommets **124***a*, **124***b* may be comprised of a rubber material to define a vapor seal configured to seal interior volume **50** (FIG. **2**) of chamber **2** from vapors. As shown in FIG. **14**, grommet **124***a* may include tapered surface **170** which abuts tapered surface **172** of inlet **8** and/or outlet **10**. Similarly, grommet **124***b* may include a tapered surface **174** which abuts a complementary tapered surface **176** of conduit **212**.

Once entry seal **210** is coupled to chamber **2** through electrofusion seal **114**, electrical lines **90** may be received through entry seal **210** for routing through chamber **2**. In particular, the outer diameter of electrical lines **90** or a conduit carrying electrical lines **90** is less than the inner diameter of conduit **112**, channels **126** of grommets **124***a*, **124***b*, and opening **122** of compression nuts **116***a*, **116***b*. More particularly, grommets **124***a*, **124***b* are configured to seal against an outer diameter of one electrical line **90** extending through channels **126** or seal against the outer diameter of a conduit carrying one or more electrical lines **90**. As such, electrical lines **90** pass extend through passageway **113**, through grommets **124***a*, **124***b*, and through compression nuts **116***a*, **116***b*. To seal interior volume **50** of chamber **2** from any vapor or fluids in passageway **113**, compression nuts **116***a*, **116***b* which pushes grommets **124***a*, **124***b* into inlet **8** and/or outlet **10** and conduit **212**, respectively, to form a hermetic seal to reduce the flow of any vapor or fluids from passageway **113** into interior volume **50** (FIG. **2**).

Referring to FIGS. **15-17**, a third embodiment of an entry seal **310** is shown. Corresponding features of entry seal **310** are similar in construction and function to features of entry seal **110**, with the corresponding features represented by identical reference numbers. Entry seal **310** includes a conduit **312** cooperating with inlet **8** and/or outlet **10** to define a passageway **313** for electrical lines **90** to pass into and out of chamber **2**. In one embodiment, conduit **312** is comprised of a polymeric material, such as high-density polyethylene. Entry seal **310** is configured to couple with wall **40**, **42** such that opening **41** through wall **40**, **42** receives conduit **312**. Conduit **312** is configured to receive one or more electrical lines **90**.

As shown in FIG. **16**, electrofusion socket winding **358** may be included on entry seal **310** for electrofusing conduit **312** to any other conduits carrying electrical lines **90**. Illustratively, electrofusion socket winding **358** is positioned within conduit **312** and configured to receive a further electrical conduit. A welder (not shown) may be operably coupled to electrofusion socket winding **358** through pins **354** and plugs **356**. Pins **354** and plugs **356** are received within shrouds **352** on support member **128**. Shrouds **352** extend laterally outwardly from support member **128** and are positioned at an approximately perpendicular orientation to shrouds **135**.

During operation of the welder, electrofusion socket winding **358** transmits heat to a portion of conduit **312** and an additional conduit. The heat transmitted from electrofusion socket winding **358** melts the portions of the conduits at electrofusion socket winding **358**. The melted portions of the conduits then fuse together to permanently and independently couple conduit **312** to additional conduits carrying electrical lines **90**.

Additionally, entry seal **310** includes both electrofusion seal **114** positioned on one side of wall **40**, **42** and a compression nut **316** positioned on the opposite side of wall **40**, **42**. Compression nut **316** may be comprised of a polymeric material, such as a nylon material, and is removably coupled to inlets **8** and/or outlets **10**. More particularly, compression nut **316** includes internal threads **320** which are threadedly coupled to external threads **318** on inlet **8** and/or outlet **10**. Because compression nut **316** is removable from inlet **8** and/or outlet **10** by unscrewing internal threads **320** from external threads **318**, access to electrical lines **90** extending through passageway **313** is achieved for installing, removing, repairing, or replacing electrical lines **90**.

As shown in FIGS. **15-17**, the compression seal of entry seal **310** further includes a grommet **324** which may be positioned within a portion of compression nut **316** and a portion of inlet **8** and/or outlet **10** for sealingly maintaining electrical lines **90** within passageway **313**. Exemplary grommet **324** may be comprised of a rubber material to form a vapor seal configured to seal interior volume **50** (FIG. **2**) of chamber **2** from vapors. As shown in FIG. **17**, grommet **324** has a tapered surface **370** configured to abut a complementary tapered surface **372** of inlet **8** and/or outlet **10**. Grommet **324** also may have a slot (not shown) in channels **326** for accessing electrical lines **90**. Additionally, grommet **324** includes a protrusion **380** which is received between opening **322** of compression nut **316** and the distal end of inlet **8** and/or outlet **10**.

Grommet **324** includes a plurality of open channels **326** to allow electrical lines **90** to extend through passageway **313** and an opening **322** of compression nut **316**. Channels **326** generally define a circle in cross-section and each channel **326** may have the same or a different diameter than adjacent channels **326**. Illustratively, grommet **324** includes five channels **326** arranged in a circular configuration, however, grommet **324** may include any number and/or configuration of channels **326**. Additionally, grommet **324** may include a circumferential rib **340** molded into at least one end of grommet **324** for further retaining electrical lines **90** and/or a conduit (not shown) within channel **326**.

Once entry seal **310** is coupled to chamber **2** through electrofusion seal **114**, electrical lines **90** may be received through entry seal **310** for routing through chamber **2**. In particular, the outer diameter of electrical lines **90** or a conduit carrying electrical lines **90** is less than the inner diameter of conduit **312**, channels **326** of grommet **324**, and opening **322** of compression nut **316**. More particularly, grommet **324** is configured to seal against the outer diameter of one electrical line **90** extending through channel **326** or is configured to seal against an outer diameter of a conduit carrying one or more electrical lines **90**. As such, electrical lines **90** pass extend through passageway **313**, through grommet **324**, and through compression nut **316**. To seal interior volume **50** of chamber **2** from any vapor or fluids in passageway **313**, compression nut **316** which pushes grommet **324** into inlet **8** and/or outlet **10** and conduit **312**, respectively, to form a hermetic seal to reduce the flow of any vapor or fluids from passageway **313** into interior volume **50** (FIG. **2**).

Referring to FIGS. **18-20**, a fourth embodiment of an entry seal **410** has corresponding features with similar construction and function to features of entry seal **310**, with the corresponding features represented by identical reference numbers. For example, illustrative entry seal **410** is identical to entry seal **310** except that entry seal **410** includes a grommet **424**, rather than grommet **324**. Grommet **424** of the compression seal of entry seal **410** includes a plurality of open channels **426** to allow electrical lines **90** to extend through passageway **313** and opening **322** of compression nut **316**. Channels **426** generally define a circle in cross-section and, illustratively, each channel **426** has the same diameter as adjacent channels **426**. Illustrative grommet **424** includes twelve channels **426** arranged in a circular configuration, however, grommet **424** may include any number and/or configuration of channels **426**. Grommet **424** also may have a slot (not shown) in channels **126** for accessing electrical lines **90** and may include a circumferential rib **440** molded into at least one end of grommet **424** for further retaining electrical lines **90** and/or a conduit (not shown) within channel **426**. In one embodiment, grommet **424** may be comprised of a rubber material.

Once entry seal **410** is coupled to chamber **2** through electrofusion seal **114**, electrical lines **90** may be received through entry seal **310** for routing through chamber **2**. In particular, the outer diameter of electrical lines **90** or the outer diameter of a conduit carrying electrical lines **90** is less than the inner diameter of conduit **312**, channels **426** of grommet **424**, and opening **322** of compression nut **316**. More particularly, grommet **424** is configured to seal against the outer diameter of one electrical line **90** extending through channel **426** or is configured to seal against an outer diameter of a conduit carrying one or more electrical lines **90**. As such, electrical lines **90** pass extend through passageway **313**, through grommet **424**, and through compression nut **316**. To seal interior volume **50** of chamber **2** from any vapor or fluids in passageway **313**, compression nut **316** which pushes grommet **424** into inlet **8** and/or outlet **10** and conduit **312**, respectively, to form a hermetic seal to reduce the flow of any vapor or fluids from passageway **313** into interior volume **50** (FIG. **2**).

Referring to FIGS. **21-23**, a fifth embodiment of an entry seal **510** has corresponding features with similar construction and function to features of entry seal **310**, with the corresponding features represented by identical reference numbers. Entry seal **510** is identical to entry seal **310** except that entry seal **510** includes a grommet **524**, rather than grommet **324**. Grommet **524** includes a plurality of open channels **526** to allow electrical lines **90** to extend through passageway **313** and opening **322** of compression nut **316**. Channels **526** generally define a circle in cross-section and each channel **526** may have the same or a different diameter than adjacent channels **526**. Illustratively, grommet **524** includes nine channels **526** arranged in a circular configuration, however, grommet **524** may include any number and/or configuration of channels **526**. As shown in FIGS. **21** and **22**, grommet **524** includes first channels **526***a* with a diameter less than second channels **526***b*. Illustratively, each first channels **526***a* is adjacent another first channel **526***a* and second channel **526***b*. In one embodiment, grommet **524** includes six first channels **526***a* and three second channels **526***b*. Grommet **524** also may have a slot (not shown) in channels **126** for accessing electrical lines **90** and may include a circumferential rib **540** molded into at least one end of grommet **524** for further retaining electrical lines **90** and/or a conduit (not shown) within channel **526**. In one embodiment, grommet **524** may be comprised of a rubber material.

Once entry seal **510** is coupled to chamber **2** through electrofusion seal **114**, electrical lines **90** may be received through entry seal **510** for routing through chamber **2**. In particular, the outer diameter of electrical lines **90** or the outer diameter of a conduit carrying electrical lines **90** is less than the inner diameter of conduit **312**, channels **526** of grommet **524**, and opening **322** of compression nut **316**. More particularly, grommet **524** is configured to seal against the outer diameter of one electrical line **90** extending through channel **526** or is configured to seal against an outer diameter of a conduit carrying one or more electrical lines **90**. As such, electrical lines **90** pass extend through passageway **313**, through grommet **524**, and through compression nut **316**. To seal interior volume **50** of chamber **2** from any vapor or fluids in passageway **313**, compression nut **316** which pushes grommet **524** into inlet **8** and/or outlet **10** and conduit **312**, respectively, to form a hermetic seal to reduce the flow of any vapor or fluids from passageway **313** into interior volume **50** (FIG. **2**).

Referring to FIGS. **24-26**, a sixth embodiment of an entry seal **610** is shown. Corresponding features of entry seal **610** are similar in construction and function to features of entry seal **310**, with the corresponding features represented by identical reference numbers. Entry seal **610** includes support member **128** which, illustratively, include a flange **664**. As shown in FIG. **26**, opening **41** of wall **40**, **42** is sized to receive flange **664**. Flange **664** may be provided on any of entry seals **110**, **210**, **310**, **410**, **510**, **610**, **710**.

Additionally, entry seal **610** includes both electrofusion seal **114** positioned on wall **40**, **42** and a plurality of compression nuts **616** also positioned on wall **40**, **42**. Electrofusion seal **114** and compression nuts **616** may be positioned on opposing sides of wall **40**, **42** or on the same side of wall **40**, **42**. Illustratively, entry seal **610** includes two compression nuts **616**. Compression nuts **616** may be comprised of a polymeric material, such as a nylon material, and are removably coupled to inlets **8** and/or outlets **10**. More particularly, each compression nut **616** includes internal threads **620** which are threadedly coupled to external threads **618** on inlet **8** and/or outlet **10**. Because compression nuts **616** are removable from inlet **8** and/or outlet **10** by unscrewing internal threads **620** from external threads **618**, access to electrical lines **90** extending through passageway **613** is achieved for installing, removing, repairing, or replacing electrical lines **90**.

As shown in FIGS. **24-26**, a grommet **624** of the compression seal of entry seal **510** may be positioned within a portion of each compression nut **616** and a portion of inlet **8** and/or outlet **10** for sealing a passageway **613**. For example, grommet **624** may be a vapor and fluid seal configured to seal interior volume **50** (FIG. **2**) of chamber **2** from vapors and fluids. Each grommet **624** includes an open channel **626** to allow electrical lines **90** to extend through both passageway **613**, through grommet **624**, and through an opening **622** of compression nut **616** in order to extend through chamber **2**. Channel **626** generally defines a circle in cross-section but may have any other size or shape. In one embodiment, grommet **624** also may have a slot (not shown) in channels **126** for accessing electrical lines **90**. Illustratively, grommet **624** has a tapered surface **670** configured to abut a complementary tapered surface **672** of inlet **8** and/or outlet **10**. In one embodiment, grommet **624** is comprised of a polymeric material, for example a rubber material.

As shown in FIGS. **25** and **26**, inlets **8** and/or outlets **10** extend from a housing **660** positioned within passageway **313** of support member **128**. Housing **660** has a cylindrical configuration and an outer diameter of housing **660** is received within the inner diameter of conduit **312** such that passageway **613** extends through housing **660**. Housing **660** is coupled to conduit **312** with electrofusion socket winding **358**. More particularly, as shown in FIG. **26**, electrofusion socket winding **358** is positioned intermediate a portion of the outer diameter of housing **660** and a portion of the inner diameter of conduit **312**. As such, when a welder (not shown) is operably coupled to electrofusion socket winding **358** through pins **354** and plugs **356**, electrofusion socket winding **358** transmits heat to a portion of conduit **312** and housing **660**. The heat transmitted from electrofusion socket winding **358** melts the portions of conduit **312** and housing **660** at electrofusion socket winding **358**. The melted portions of conduit **312** and housing **660** then fuse together to permanently couple conduit **312** to housing **660** for carrying electrical lines **90** through conduit **312**, through housing **660**, and through compression nuts **616**.

As shown in FIGS. **25** and **26**, housing **660** also includes an interior shoulder **666** abutting inlets **8** and/or outlets **10**. Shoulder **666** of housing **660** is configured to receive a plurality of potting members **662**. Potting members **662** include a head portion **662*a*** and a leg portion **662*b***. A transverse surface **662*c*** of head portion **662*a*** is configured to abut shoulder **666** of housing **660**. As such, when entry seal **610** is assembled, head portion **662*a*** is positioned within housing **660** and leg portion **662*b*** extends into inlets **8** and/or outlets **10**. An internal channel **668** of potting members **662** is configured to align with channel **626** of grommet **624** to allow electrical lines **90** to extend through conduit **312**, through housing **666**, and through compression nuts **616** in order to extend through chamber **2**. In one embodiment, potting members **662** are comprised of a polymeric material configured to sealingly maintain electrical lines **90** within conduit **312** and channels **626**, **668**.

Once entry seal **610** is coupled to chamber **2** through electrofusion seal **114**, electrical lines **90** may be received through entry seal **610** for routing through chamber **2**. In particular, the outer diameter of electrical lines **90** or the outer diameter of a conduit carrying electrical lines **90** is less than the inner diameter of conduit **312**, channels **626** of grommet **624**, and opening **622** of compression nut **616**. More particularly, grommet **624** is configured to seal against the outer diameter of one electrical line **90** extending through channel **626** or is configured to seal against an outer diameter of a conduit carrying one or more electrical lines **90**. As such, electrical lines **90** pass extend through passageway **613**, through grommet **624**, and through compression nut **616**. To seal interior volume **50** of chamber **2** from any vapor or fluids in passageway **613**, compression nut **616** which pushes grommet **624** into inlet **8** and/or outlet **10** and conduit **312**, respectively, to form a hermetic seal to reduce the flow of any vapor or fluids from passageway **613** into interior volume **50** (FIG. **2**).

Referring to FIGS. **27-29**, a seventh embodiment of an entry seal **710** is shown. Corresponding features of entry seal **710** are similar in construction and function to features of entry seal **610**, with the corresponding features represented by identical reference numbers. Entry seal **710** includes both electrofusion seal **114** positioned on wall **40**, **42** and a plurality of compression nuts **716** positioned on wall **40**, **42**. Electrofusion seal **114** and compression nuts **716** may be positioned on opposing sides of wall **40**, **42** or on the same side of wall **40**, **42**. Illustratively, entry seal **710** includes three compression nuts **716**. Compression nuts **716** may be comprised of a polymeric material, such as a nylon material, and are removably coupled to inlets **8** and/or outlets **10**. More particularly, each compression nut **716** includes internal threads **720** which are threadedly coupled to external threads **718** on inlet **8** and/or outlet **10**. Because compression nuts **716** are removable from inlet **8** and/or outlet **10** by unscrewing internal threads **720** from external threads **718**, access to electrical lines **90** extending through a passageway **713** is achieved for installing, removing, repairing, or replacing electrical lines **90**.

As shown in FIGS. **27-29**, a grommet **724** of the compression seal of entry seal **710** may be positioned within a portion of each compression nut **716** and a portion of inlet **8** and/or outlet **10** for sealing passageway **713**. For example, grommet **724** may be comprised of a rubber material to define a fluid and vapor seal configured to seal interior volume **50** (FIG. **2**) of chamber **2** from fluids and vapors. Grommet **724** includes an open channel **726** to allow electrical lines **90** to extend through both passageway **713** and an opening **722** of compression nut **716** in order to extend through chamber **2**. In one embodiment, grommet **724** also may have a slot (not shown) in channels **126** for accessing electrical lines **90**.

Grommet **724** has a tapered surface **770** and inlet **8** and/or outlet **10** also include a complementary tapered surface **772** configured to receive tapered surface **770** of grommet **724**, as shown in FIG. **29**. As such, tapered surface **770** of grommet **724** is received within inlet **8** and/or outlet **10** and grommet **724** extends from inlet **8** and/or outlet **10** into compression nut **716** to sealingly maintain the position of electrical lines **90** at inlet **8** and/or outlet **10**.

Once entry seal **710** is coupled to chamber **2** through electrofusion seal **114**, electrical lines **90** may be received through entry seal **710** for routing through chamber **2**. In particular, the outer diameter of electrical lines **90** or the outer diameter of a conduit carrying electrical lines **90** is less than the inner diameter of conduit **312**, channels **726** of grommet **724**, and opening **722** of compression nut **716**. More particularly, grommet **724** is configured to seal against the outer diameter of one electrical line **90** extending through channel **726** or is configured to seal against an outer diameter of a conduit carrying one or more electrical lines **90**. As such, electrical lines **90** pass extend through passageway **713**, through grommet **724**, and through compression nut **716**. To seal interior volume **50** of chamber **2** from any vapor or fluids in passageway **713**, compression nut **716** which pushes grommet **724** into inlet **8** and/or outlet **10** and conduit **312**, respectively, to form a hermetic seal to reduce the flow of any vapor or fluids from passageway **713** into interior volume **50** (FIG. **2**).

Various features of each embodiment of entry seals **110**, **210**, **310**, **410**, **510**, **610**, **710** may be used with any other feature of any other entry seal disclosed herein. Therefore, any of the features disclosed herein with respect to entry seals **110**, **210**, **310**, **410**, **510**, **610**, **710** may be combined to form alternative embodiment entry seals in accordance with the present disclosure.

While this invention has been described as having an exemplary design, the present invention may be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practices in the art to which this invention pertains.

What is claimed is:

1. A chamber for a fueling system, comprising:

a housing having a lower surface and including at least one raised portion and at least one recessed portion;

a plurality of inlets to the housing; and

a plurality of outlets from the housing, wherein electrical lines extending between the inlets and the outlets are positionable within the at least one recessed portion below the at least one raised portion, the at least one raised portion extending to a height within the housing and presenting an upper surface within the housing on which a service technician positioned in the housing may step without stepping on electrical lines positioned below the raised portion, whereby the service technician can step on the raised portion without disturbing the electrical lines positioned in the recessed portion.

2. The chamber of claim **1**, wherein the housing defines a unitary structure and is configured to receive a first plurality of electrical lines having a first voltage and a second plurality of electrical lines having a second voltage.

3. The chamber of claim **2**, further comprising a panel received within the housing and positioned between the first plurality of electrical lines and the second plurality of electrical lines, wherein the housing includes a support member supporting the panel.

4. The chamber of claim **3**, wherein at least one of the raised portions of the lower surface includes a second support member.

5. The chamber of claim **1**, wherein the plurality of inlets are sealed to the electrical lines with a compression fitting.

6. The chamber of claim **1**, wherein the plurality of outlets are sealed to the electrical lines with a compression fitting.

7. The chamber of claim **1**, further comprising an entry seal positioned on the housing at one of the inlets and configured to be electrofused to the housing, the entry seal including a compression fitting.

8. The chamber of claim **1**, further comprising an entry seal positioned on the housing at one of the outlets and configured to be electrofused to the housing, the entry seal including a compression fitting.

9. A chamber for a fueling system, comprising:

a housing having a first wall, a second wall opposite the first wall, a third wall coupled to the first and second wall, a fourth wall opposite the third wall, and a lower surface coupled to the first, second, third, and fourth walls;

a first support member positioned on the first wall adjacent an upper end of the first wall;

a second support member positioned on the first wall adjacent a lower end of the first wall, spaced apart from the first support member and spaced apart from the lower surface;

a third support member positioned on the second wall;

a fourth support member positioned on the second wall, spaced apart from the third support member and spaced apart from the lower surface;

a plurality of inlets to the housing;

a plurality of outlets from the housing; and

a panel configured to be positioned within the housing and supported by the first, second, third, and fourth support members.

10. The chamber of claim **9**, wherein the panel includes a fifth support member configured to engage the lower surface of the housing.

11. The chamber of claim **9**, wherein the panel includes an opening along an upper portion of the panel.

12. The chamber of claim **9**, wherein the panel includes a first recessed portion and a second recessed portion along a lower portion of the panel.

13. The chamber of claim **12**, wherein the panel includes a fifth support member configured to engage the lower surface of the housing and the fifth support member is positioned intermediate the first and second recessed portions.

14. The chamber of claim **13**, wherein the lower surface of the housing includes at least one raised portion and at least one recessed portion, and at least one of the first and second recessed portion of the panel is configured to receive the at least one raised portion of the lower surface.

15. A chamber for a fueling system, comprising:

a housing having a first wall, a second wall opposite the first wall, a third wall coupled to the first and second wall, a fourth wall opposite the third wall, and a lower surface coupled to the first, second, third, and fourth walls;

a first support member positioned on the first wall;

a second support member positioned on the first wall and spaced apart from the first support member;

a third support member positioned on the second wall;

a fourth support member positioned on the second wall and spaced apart from the third support member;

a plurality of inlets to the housing;

a plurality of outlets from the housing; and

a panel configured to be positioned within the housing and supported by the first, second, third, and fourth support members;

wherein a plurality of electrical lines extends between the inlets and the outlets and includes a first plurality of low-voltage electrical lines and a second plurality of high-voltage electrical lines, and the panel is positioned intermediate the first plurality and the second plurality of electrical lines.

16. The chamber of claim **15**, wherein the first support member is positioned adjacent an upper end of the first wall and the second support member is positioned adjacent a lower end of the first wall.

17. The chamber of claim **16**, wherein the third support member is positioned adjacent an upper end of the second wall and the fourth support member is positioned adjacent a lower end of the second wall.

18. The chamber of claim **17**, wherein the first and fourth support members are positioned substantially within a plane extending perpendicularly between the first and second walls.

19. The chamber of claim **17**, wherein the second and third support members are positioned substantially within a plane extending perpendicularly between the first and second walls.

20. A fitting for sealing an opening through a wall forming a part of a fueling system, the fitting comprising:

a first surface;

a heating element positioned to heat the first surface of the fitting and the wall forming a part of the fueling system when the fitting is operably positioned adjacent the opening in the wall, whereby heating the first surface of the fitting and the wall with the heating element causes the fitting and the wall to bond and form a seal therebetween; and

a compression fitting forming a removable compression seal.

21. The fitting of claim **20**, wherein the compression fitting comprises a threaded fitting extension defining a conduit and a grommet sized to fit within the conduit of the extension and having at least one opening sized to accommodate one of an electrical cable and a conduit extending through the grommet.

22. The fitting of claim **21**, wherein the compression fitting comprises a compression nut threadably engagable with the threaded fitting extension, the compression nut operable to compress the grommet between the threaded fitting extension and the one of an electrical cable and a conduit extending through the grommet.

23. The fitting of claim **21**, further comprising a support member and the heating element is supported on the support member.

24. The fitting of claim **21**, wherein the at least one opening includes at least five openings.

25. The fitting of claim **20**, further comprising a conduit and a second heating element is positioned within the conduit.

26. A chamber for a fueling system, comprising:

a housing having at least one wall;

a plurality of inlets to the housing and including the fitting of claim **20**, each inlet being configured to receive at least one electrical line; and

a plurality of outlets from the housing.

27. The chamber of claim **26**, wherein the compression fitting is removably coupled to one of the plurality of inlets.

28. The chamber of claim **26**, wherein the grommet is positioned within a portion of the compression fitting and a portion of one of the inlets.

29. The chamber of claim **26**, wherein the fitting further comprises a housing received within a conduit of the fitting, and at least one of the inlets extends from the housing.

30. The chamber of claim **29**, wherein at least two of the inlets extend from the housing.

* * * * *